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ABSTRACT

A project was conducted to develop a cost-effectiveness model and data instruments to be utilized in the management of secondary vocational programs. Based upon reviewed literature, cost effectiveness analysis was conceptualized as an analytical technique and eight key elements were identified. The model that was then developed includes four major components: Vocational program classifications, program objectives and specifications, program outputs, and costs. Based upon the four components, the model was designed to generate three kinds of cost-effectiveness measures: (1) Program effectiveness, (2) cost efficiency, and (3) cost-effectiveness ratio and/or performance ratio. Five kinds of data instruments were produced: (1) School corporation information, (2) secondary vocational instructional program data, (3) student follow-up program rating scale, (4) employers' option on vocational training of employees, and (5) vocational instructional program cost data. In addition, a standard procedure for using the model and data instruments was conceptualized as three primary activities: Planning, implementing, and utilizing. A project advisory committee and national advisory panel for the project revieved materials developed by the project staff making conclusions and recommendations. (Author/ED)

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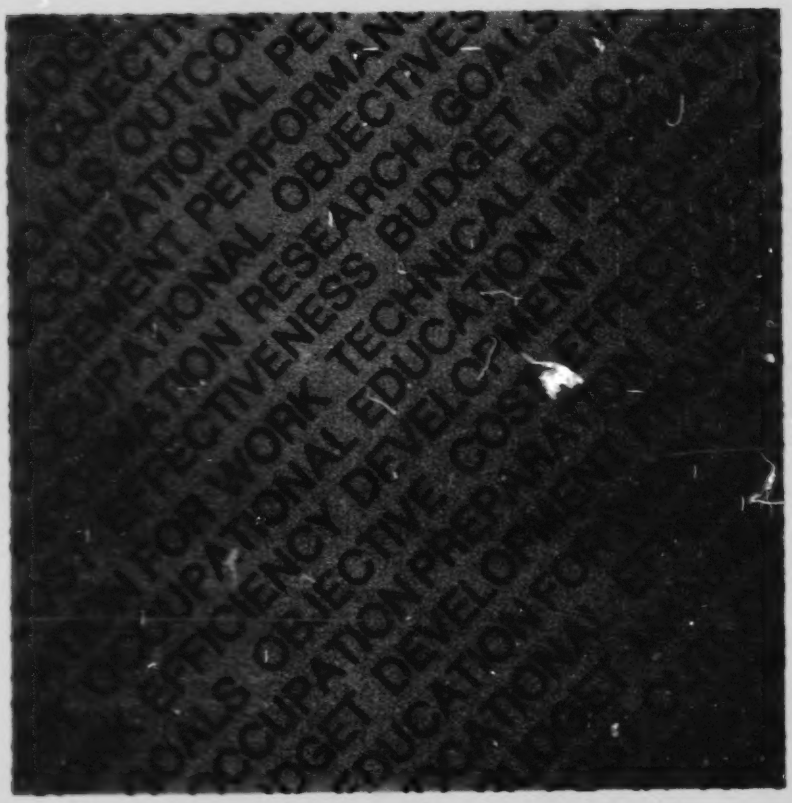
Technical Report

A COST-EFFECTIVENESS ANALYSIS MODEL FOR SECONDARY VOCATIONAL PROGRAMS



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ABSTRACT

Purpose. A cost-effectiveness model and data instruments to be utilized in the management of secondary vocational programs were developed in the project. This report covers a rationale for the model and description of the model elements.

Procedures. Based upon reviewed literature, cost-effectiveness analysis was conceptualized as an analytical technique. Eight key elements were identified. As a conceptual framework, a cost-effectiveness model was developed that generated three types of cost-effectiveness measures. The types of cost-effectiveness measures were tested using hypothetical data. Data collection instruments, standard procedure for using the model, and data instruments were developed. A Project Advisory Committee and National Advisory Panel for the project reviewed materials developed by the project staff.

Products. This technical report synthesizes literature related to cost-effectiveness concepts and notes a theoretical basis for cost-effectiveness analysis of secondary vocational programs. The cost-effectiveness analysis model includes four major components: vocational program classifications, program objectives and specifications, program outputs, and costs. Based upon the four major components, the model was designed to generate three kinds of cost-effectiveness measures: (1) program effectiveness, (2) cost efficiency, and (3) cost-effectiveness ratio and/or performance ratio .

Five kinds of data instruments were produced: (1) school corporation information, (2) secondary vocational instructional program data, (3) student follow-up program rating scale, (4) employers' opinion on vocational training of employees, and (5) vocational instructional program cost data. In addition, a standard procedure for using the model and data instruments were conceptualized as three primary activities: planning, implementing, and utilizing. These phases are delineated in this report.

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CHAPTER I

Introduction

This report presents a cost-effectiveness analysis model for secondary vocational programs as a technical report from the Indiana Cost-Effectiveness Project. The project was carried out at Indiana University--Bloomington with the financial support of the Indiana State Board of Vocational and Technical Education. The purpose of the project was to develop a cost-effectiveness analysis model and administrator's manual for guiding locally conducted cost-effectiveness studies of secondary vocational programs. The manual was developed as a practical report separate from this technical report. The statement of the objectives, procedures, and organization of this report follows.

OBJECTIVES AND PROCEDURES

The objectives of this report were to (1) conceptualize a cost-effectiveness analysis, (2) develop a cost-effectiveness analysis model and instruments, and (3) evaluate the model and instruments for validation in their use. To reach these objectives, the following procedures were utilized:

First, based on a review of the related literature, a cost-effectiveness analysis was defined and eight elements were identified. The cost-effectiveness analysis concept was distinguished from the concept of cost-benefit analysis but related to Planning, Programming, Budgeting System (PPBS). Some research studies on cost analysis, cost-benefit

analysis, and cost-effectiveness analysis of secondary vocational programs were reviewed along with needs for cost-effectiveness analysis of such programs.

Second, based upon the reviewed literature, a conceptual model for cost-effectiveness analysis of secondary vocational programs was developed for use. The model consists of four major components: vocational program structure, objectives, costs, and outputs; three measures: effectiveness efficiency, and a C/E and performance ratio; and two additional factors: student and community characteristics. Data instruments and forms were also developed as was a standard procedure for using this model.

Third, an advisory committee for the project implementation, consisting of three local vocational directors, three state vocational officers, and one professor, reviewed and made comments on the development of the cost-effectiveness analysis model and instruments. The efforts of the committee were focused upon the development of program objectives and their specifications. The committee members validated a set of program objectives and specifications. They also advised the use of the state, recommended accounting system, which appeared in Handbook II (U.S. Office of Education, Financial Accounting, 1973), for analyzing costs of vocational programs.

Fourth, in the process of the product's development, a national advisory panel was consulted for review and comments on the cost-effectiveness analysis model and technical procedures. Their reading and comments on an earlier draft of this report were reflected in finalizing the draft. However, the consulting advice and assistance did not reflect

individual or panel endorsement of the study and its products.

Fifth, quarterly reports on the progress of the project were presented to the State research coordinator, the project monitor, and the third party evaluator. The project received favorable responses from the project monitor and the third party evaluator.

Finally, to increase the usefulness of the model and instruments, a site visitation was conducted in three school corporations in the state of Indiana. Throughout the site visitation, the model and data collection instruments were examined by vocational directors and business managers in terms of data availability, ease of data collection, and formats of instruments. Original instruments were revised to simplify the collection of the required data on the major components of the cost-effectiveness model. Hypothetical data were used for testing cost-effectiveness measures as developed in the model.

ORGANIZATION OF REPORT

This report is organized into four chapters. Following Chapter I, Chapter II reviews the theoritical basis for cost-effectiveness analysis, the need for such analysis, and research studies on cost-effectiveness analysis of secondary vocational programs.

Chapter III describes the conceptual model and specifications for cost-effectiveness analysis of secondary vocational programs. It also includes the development of data types, instruments and analytical forms, along with a standard procedure for using the model.

Chapter IV discusses the evaluation of the cost-effectiveness

analysis model and instruments, along with examination of cost-effectiveness measures. The chapter makes conclusions and recommendations including suggestions for further studies which are followed by supporting documents such as references and appendices.

CHAPTER II

Theoretical Basis for Cost-Effectiveness

This chapter presents concepts of cost-effectiveness analysis and the need for vocational education program evaluation and planning, and it reviews some research studies on cost-effectiveness analysis of vocational programs at the secondary school level.

CONCEPTS OF COST-EFFECTIVENESS ANALYSIS

An operational definition of cost-effectiveness analysis provides a groundwork for conceptualizing cost-effectiveness as an analytical technique. It is distinguished from the cost-benefit concept for this project. The role of cost-effectiveness analysis is related to PPBS, Planning, Programming, and Budgeting Systems.

Definition and Elements

Cost-effectiveness analysis is defined in different ways from different perspectives. Quade (1967) defines cost-effectiveness analysis in a broad sense as an "analytical study designed to assist a decision-maker in identifying a preferred choice among possible alternatives," and, narrowly, it is a "comparison of alternative courses of action in terms of their costs and their effectiveness in attaining some specific objectives" (pp. 1-2). Under the definition, he indicates five elements of analysis: (1) the objectives, (2) the alternatives as the means by which it is hoped the objectives can be attained, (3) the costs,

(4) the model which, as a simplified representation of the real world, abstracts the features of the situation relevant to the question being studied, and (5) a criterion as a rule or standard by which to rank the alternatives in order of desirability and choose the most promising (pp. 4-5). Benson (1968, p. 257) emphasizes systematic examination and comparison of alternative courses of action for cost-effectiveness analysis on the basis of critical appraisal of both the assessment of (1) direct and indirect costs in the present and future and (2) gains and benefits that accrue to each of the different courses of action.

In other words, the term cost-effectiveness analysis is expressed as a procedure by means of which the costs of alternative means of achieving a stated objective, or, conversely, the effectiveness of alternative means for a given cost, are compared in a series of numerical indices (Seiler, 1969). For an instructional cost-effectiveness analysis, the analysis is defined as "the process of solving problems of choice requiring the definition of measurable objectives, identification of alternative ways of achieving the objectives, identification of the anticipated cost and effectiveness for each alternative, and identification of the optimum alternative which potentially achieves the desired objectives for the educational activities of a school" (Cary, 1972, p. 61).

Knezevich (1973) defines a cost-effectiveness analysis as a "systematic examination of an alternative in terms of its advantages, as measured by a fixed level and quality of an outcome, and disadvantages, as measured by the economic cost" (p. 326). He also operationalizes the nature of cost-effectiveness analysis into a series of activities: (1) specification of objectives, (2) identification of alternative means, (3) generation

of a model for the problem under study, (4) computation of costs (disadvantages) for each alternative means to an objective, (5) determination of effectiveness (advantages) for each alternative, (6) computing the degree of relationship between cost and effectiveness for alternatives, (7) agreeing on a criterion, that is, a rule or standard, to be used for ranking and selecting alternative means to an objective, and (8) recognizing the importance of iterative processes for confirming refinement of the analysis (p. 185).

Thus, the concept of cost-effectiveness analysis is defined in different ways, and most definitions infer a simulation of cost-effectiveness of alternative programs or courses of action to accomplish predetermined objectives. However, the use of cost-effectiveness analysis is available not only for comparison of alternative programs, but also for assessment of the effectiveness of operating programs as compared with associated costs. From this point of view, an operational definition of cost-effectiveness analysis is: an analytical tool for assessing outputs of operating or alternative programs in achieving specified program objectives, as related to the costs. Furthermore, the following elements are identified:

1. The Program or Alternatives. The first element is to define the operating or alternative program for achieving certain goals or objectives.

2. Program Objective(s). Program objectives are specified by certain target goals that the program should reach.

3. The Costs. Costs are amounts expended for the purpose of achieving program objectives.

4. The Output. Outputs are the products or expected results from the program. They are often numerically expressed indicating the actual attainment of program objectives.

5. A Model. A model is a simplified representation of the relationships among the elements mentioned above. The purpose of the model is to produce critical measures to be used in the decision-making process.

6. The Effectiveness. Effectiveness is a measure of the extent to which the objective is achieved.

7. The Efficiency. Efficiency is a measure of the relationship between the output and the cost.

8. A Ratio. An index ratio or criterion by means of which the desirability of a program is indicated on the basis of the degree of program effectiveness over costs.

Accordingly, the development of a cost-effectiveness analysis model for secondary vocational programs was directed toward (1) defining vocational programs, (2) specifying program objectives, (3) assessing outputs as associated with objectives, and (4) estimating program costs. The model will produce three measures of effectiveness, efficiency, and a ratio.

Cost-Effectiveness and Cost-Benefit Analysis

The definition of cost-effectiveness analysis is distinguished from cost-benefit analysis. Both of these concepts are used for assessing outputs over the common denominator of costs. However, there are differences in techniques for measuring effectiveness and benefit for each analysis. Whereas effectiveness is measured by the achievement degree of program objectives, benefit is measured in a monetary unit.

As an economic analysis for assessing alternative programs, cost-benefit analysis is directed toward a comparison of the costs and the resulting monetary benefits of one or more programs. It attempts to generate three criteria: (1) the net expected present value, (2) the benefit-cost ratio, and (3) the expected internal rate of return (Stromsdorfer, 1972, p. 12). Thus, in a cost-benefit analysis, both inputs and outputs

are expressed in monetary terms (Alkin, 1970, p. 222; Rossmiller & Geske, 1976, p. 489). For instance, a cost-benefit analysis of a vocational education program attempts to identify all monetary benefits resulting from the program. As a criterion for evaluating the program, it provides a ratio of the total value of benefits (in dollars) over the total costs, or a rate of return to investment in the vocational education program.

Unlike cost-benefit analysis, cost-effectiveness analysis concentrates on the measure of specified goal attainments of the program against the associated costs. "When the effectiveness of programs in achieving a particular goal [rather than their monetary values] is linked to costs," Levin (1975) contends, "the approach is considered to be a cost-effectiveness rather than a cost-benefit analysis" (pp. 92-3). Since the effectiveness is not the same as the unit of costs, this analysis generates a ratio that reveals some degree of effectiveness as compared with cost or efficiency of the program. The ratio assists in making decisions either to minimize dollar costs subject to some degree of effectiveness, or to maximize the measure of effectiveness with a budget constraint.

Cost-effectiveness analysis and cost-benefit analysis are popular terms for components of systems analysis. They provide a criterion or ratio for evaluating operating and/or alternative programs in terms of the total value of gains over the total costs. In educational contexts, however, some benefits are easily identified, but not all the educational outcomes are measured by monetary benefits. It is also quite difficult to define the scope of a cost-benefit study when to conduct such a study may require information spanning a lifetime after schooling. The effectiveness measure is more easily identified and obtainable than measurement

of benefits, because the scope can be determined by the selected objectives of the program which is to be analyzed. Therefore, cost-effectiveness is considered more applicable to evaluate educational programs (Knezevich, 1973, pp. 184-5; Forbes, 1974, p. 21).

Cost-Effectiveness and PPBS

Cost-effectiveness analysis is of significance in a systems analysis approach such as Planning Programming Budgeting System (PPBS). Sometimes it is perceived to be the systems analysis process itself, including not only a comparison of alternative programs, but also the specification of sensible objectives, the determination of a satisfactory way to measure performance, and the influence of considerations that can not be quantified (Quade, 1966, and 1967). Others see cost-effectiveness analysis as being related to and a subset of the total systems design process. For example, Heaton (1969, p. 35) identifies cost-effectiveness analysis with alternative trade-off studies, one of four phases of systems analysis which follows the first two phases of goal definition and alternative development, and which precedes the final phase of alternative selection. Both viewpoints of the role of cost-effectiveness analysis could be appropriate, depending on the time and conditions that the analysis requires.

As an analytical technique, cost-effectiveness analysis is of significance in the PPBS context. In essence, PPBS, or as it is sometimes called, program budgeting, was originally developed as an analytical means of planning federal programs. Under the PPB system, each department was requested, by President Johnson, to develop its objectives and goals; to evaluate each of its programs to meet these objectives, weighing the benefits against the costs; to examine alternative means of achieving these

objectives; to shape its budget request on the basis of this analysis, and to justify that request in the context of a long-range program and financial plan (Lyden & Miller, 1968, p. 5).

According to Hatry and Cotton (1967), systematic analysis of alternatives is the crux of PPBS. It includes: (1) identification of the governmental objectives; (2) explicit systematic identification of alternative ways of carrying out the objectives; (3) estimation of the total cost implications of each alternative; (4) estimation of the expected results of each alternative, and (5) presentation of resulting major costs and benefit trade-offs among the alternatives (p. 15). From the future perspective, cost-effectiveness analysis is integrated into a PPB system as shown in the following statements (Mushkin, 1967, p. 1):

1. Clarifying and specifying the ultimate goals or objectives of each activity for which a government budgets money.
2. Gathering like activities into comprehensive categories or programs designed to achieve the specified objectives.
3. Examining as a continuous process how well each activity or program has done; its effectiveness.
4. Analyzing proposed improvements or new program proposals to see how effective they may be in achieving program goals.
5. Projecting the entire costs of each proposal not only for the first year, but for several subsequent years.
6. Formulating a plan, based in part on the analysis of proposed cost and effectiveness, that leads to implementation through the budget.

Furthermore, Knezevich (1973, p. 4) developed the PPBADERS cycle of activities: (1) Planning for clarifying goals; (2) Programming for generating alternative approaches to goals (3) Budgeting for translating programs into fiscal requirements; (4) Analyzing for determining cost-effectiveness of alternatives; (5) Deciding the optimum course of action;

(6) Evaluating outcomes and relating each to prior expectations, and (7) Recycling for feeding evaluative judgements into the system to begin a modified PPBADER cycle. The cycle concept shows not only the relationship of cost-effectiveness analysis with PPB systems, but also its role in evaluating and planning educational programs.

Thus, cost-effectiveness analysis is a prerequisite within a PPB system. The potential of PPBS would be determined by the depth of the analysis for identifying full cost implications and gains of program alternatives. Also the analysis can be undertaken with the emphasis on educational program evaluation and planning, whether or not such analysis is part of an integrated PPB system. The results of cost-effectiveness analysis of educational programs could provide for cost implications, effectiveness of program alternatives in attaining objectives, and information that is brought together to give greater precision to the decision-making process.

NEEDS FOR COST-EFFECTIVENESS ANALYSIS

A cost-effectiveness analysis can be used for guiding vocational administrators' decisions concerning the allocation and utilization of resources, and the evaluation and planning of vocational education programs. Furthermore, the increasing demand and support for vocational education programs require systematic analyses of the gains and costs of the programs. As analytical techniques, cost-effectiveness analyses should be helpful in providing rationales for supporting vocational education.

Resource Allocation and Utilization

Cost-effectiveness analyses can be directed toward optimization of resource allocation and utilization to increase economic efficiency of vocational education programs.

During the past decade there has been growing interest in the economic aspects of education. Three reasons for the growing interest are cited by O'Donoghue (1971, p. 1): (1) the increase in the volume of educational activity which makes education one of the largest industries and one of the chief employers of highly skilled personnel, (2) the recognition that education may have a significant influence on the employment and income opportunities open to people and may affect the distribution of income and wealth in society, and (3) the post war emphasis on economic growth and development.

An economic viewpoint of education concerns the efficiency which the resources allocated to education are utilized (Blaug, 1970). The general question of efficiency in public expenditures is one which recently has received considerable attention from economists. It is, however, important to recognize that economic efficiency means not conducting education on a "least-cost" basis, but "the achievement of a given objective with the least cost or the maximization of a given objective with a given cost" (Kaufman, 1968, p. 6).

The growing interest and recognition of education in economic growth generated efforts toward maximizing the gains from scarce resources. One of these efforts is cost-effectiveness analysis. Seiler (1969) related cost-effectiveness analysis to classic economic theory when he assumed, "the similarity between the two is apparent when one considers a

well-accepted definition of economics as being concerned with the allocation of scarce resources, among competing ends to maximize satisfaction" (p. 2). According to Levin (1975), the focus of cost-effectiveness analysis is to explore "a strategy or a combination of strategies that maximize the results for any particular resource or budget constraint" (p. 89).

As a decision model for an optimal allocation or utilization of resources, cost-effectiveness analysis may be used to provide decision-makers with a useful criterion in allocating or utilizing a given set of resources among numerous competing needs in rational and optimal ways. A cost-effectiveness analysis of vocational education programs can be made for the purpose of comparing them with general and academic programs or to identify the most desired program among competitive vocational programs. As a result, the analysis could increase economic efficiency by allocating a given amount of resources to the most worthy of vocational education programs.

Vocational Program Evaluation and Planning

Cost-effectiveness analysis is needed for the evaluation, development, and planning of vocational education programs. Kaufman (1968) views cost-effectiveness analysis as a method for the evaluation of vocational education. He contends that "evaluation requires (1) the analysis of measured quantities in terms of the attainment of objectives and progress toward goals, (2) an estimate of the value of existing programs in determining this progress, and (3) an estimate of the costs involved in the conducting of these programs" (p. 10). The purpose of evaluation is to provide "useful information for judging decision alternatives" (Stufflebeam, et. al., 1971, xxv). As an evaluating technique, cost-effectiveness

analysis is expected to provide the decision maker with information related to the "cost of achieving program objectives; overall effectiveness of a program in achieving its objectives; and program effectiveness with subgroups of students" (Forbes, 1974, p. 21). This information is of value in determining if existing vocational programs should be expanded, continued, modified, or deleted.

In addition to program evaluation at the operations level, cost-effectiveness analysis may be used for developing new programs. Cost-effectiveness evaluation of a newly developed instructional product or set of materials may be used to compare a proposed program with the conventional mode of education or to compare two new instructional products (Wentling and Lawson, 1975, p. 310). On the other hand, alternative programs for achieving a certain objective can be evaluated in terms of their costs related to their payoffs. In this case, the existing conventional program should be replaced by the most effective alternative program.

Furthermore, cost-effectiveness analysis provides useful information for program planning. Schwarz (1968) discusses cost-effectiveness analysis in long-range planning, which consists of: (1) the setting of objectives, (2) forecasts of future environment, (3) determination of different alternatives, and (4) determination of a preferred course of action considering the objectives, the possibilities, and the constraints (p. 32). He also assumes that the character of cost-effectiveness analysis in educational planning varies between different types of decision problems or different decision levels (p. 38).

Carpenter and Haggart (1970) view cost-effectiveness analysis as

a tool that can assist the planner in relating the resources required by an educational program to its effectiveness. For planning purposes, they contend that analysis may be used to: (1) help assess the relative worth of several innovative programs with the same educational outcome, (2) determine whether a simple program is becoming more or less effective as time passes, or (3) help assess the relative worth of the same program for different school settings (pp. 1-2).

It is an essential part of program planning to relate resources to outputs. Consequently, cost-effectiveness analysis can be used for vocational program planning in order to maximize the effectiveness with a given amount of resources for the program or, alternatively, to produce the same level of effectiveness at the lowest possible cost.

Demand and Support for Vocational Education

The demand and support for vocational education have been well reflected in federal legislation, beginning with the Smith-Hughes Act (1917). The act provided for seven million dollars for the promotion of vocational agriculture, trades and industry, and home economics education. The George Barden Act of 1946 brought about a further expansion of the program. It authorized the expenditure of some 29 million dollars beyond the perpetual seven million dollars of the Smith-Hughes Act. In 1956 the act was amended to add practical nursing and fishing occupations to the list of approved areas of instruction. The National Defense Education Act of 1958 contained a provision for both secondary and post-secondary emphasis on technical training by means of the development of area vocational schools.

Vocational education took on a much broader prospectus after the

Vocational Education Act of 1963. The new funds were to be expended for state and local vocational education programs under six broad categories designed to fit individuals for gainful employment, including business and office occupations not covered by the previous laws. Basically, the restrictiveness of the older acts was reduced, thus making them more appropriate to current needs. As a result, several categories were broadened, without the categorical limitations of the older legislation. The new act contained significant features to keep vocational education abreast of changes in the labor market by bringing vocational preparation to many groups not served by the present program. The act authorized 60 million dollars for fiscal 1964, 118.5 million dollars for fiscal 1965, 177.5 million dollars for fiscal 1966, and 225 million dollars for all following years.

The Vocational Education Act of 1963 was amended to help the "hard-to-reach" and the "hard-to-teach," with additional funding and program flexibility at the discretion of state and local school agencies. Primarily as an extension of the 1963 act, the 1968 amendment stressed the importance of meeting the needs of individuals through annual and long-term state planning, curriculum revision, exemplary programs, continuous evaluation, etc. and created a national advisory committee. It authorized 542 million dollars, 858 million dollars, 870 million dollars, 910 million dollars, and 565 million dollars for the fiscal years 1969, 1970, 1971, 1972, and 1973, respectively. Thus the demand for vocational education expanded its programs and increased federal support through legislation.

This trend clearly appeared at the state level. Increasing enrollments required more funds to support vocational education programs. In

the case of the state of Indiana, the total vocational education enrollment increased from 82 thousand in 1967 to 175 thousand in 1975, with an increase of 114 percent (Annual Report, 1975, p. 1). The secondary vocational enrollment as compared to the total secondary enrollments also increased 17 percent to 31.3 percent during the same period (p. 5). Federal vocational education expenditures in Indiana increased to 14 million dollars in 1975 from 6.8 million dollars in 1967 (p. 6). Approximately half of the total amount was expended for secondary vocational programs. The state demand and support for vocational education will continue to be expanded. The Indiana State Plan for Vocational Education (1976) projects vocational enrollments at the secondary level to be 112 thousand by the 1976 fiscal year and 128 thousand by fiscal year 1980. A total amount of 48 million dollars will be needed for secondary vocational education programs in fiscal year 1980.

As the demand and support for the vocational education programs increases, so does the need for evaluating vocational programs. The 1963 Vocational Education Act and 1968 Amendments required the establishment of national and state advisory councils. One of the main tasks assigned to the council was to evaluate vocational programs and to develop short and long-range vocational education plans. Cost-effectiveness analysis approaches could be helpful to identify useful criteria for these evaluation and planning purposes. Even local vocational administrators may need locally conducted cost-effectiveness analyses and receive public and community support for their vocational programs by providing publics with useful information gained from the analyses.

COST-EFFECTIVENESS ANALYSIS OF VOCATIONAL PROGRAMS

During the past decade research reports on cost analyses, cost-benefit, and cost-effectiveness analyses of secondary vocational programs appeared under contracts with the U.S. Department of Health, Education, and Welfare. Some dissertation studies attempted to develop instructional cost-effectiveness analysis models for decision-making.

Cost Analysis

Dueker and Altman (1967) attempted to identify the kinds of cost and related data that can be obtained to aid planning and evaluating vocational education. Based on data collected from sixteen comprehensive and sixteen vocational schools, they analyzed costs in relation to school performance, operational-situational factors, and unemployment rate. In particular, according to the data reported by five vocational schools and four comprehensive schools, the general cost of education in comprehensive schools was lower than in vocational schools for 1961-62, but rose much more rapidly to approximate the cost in vocational schools by 1965-66.

An analysis of vocational program costs at the secondary and post-secondary levels was made to assist state and local administrators in obtaining financial support (Aldrich, III, 1972). Developmental efforts were given to (1) budget chart of accounts (direct instruction, indirect instructional costs, and non-instructional service grouping); (2) proration of indirect costs; (3) base unit of measurement, and (4) cost estimation formula. The analysis of data from three high school districts

and one community college district from each of six states revealed that: (1) appropriate proration of indirect costs for general support and plant operation and maintenance is critical in determining precise total cost of an instructional service, (2) high school districts place less emphasis on instructional equipment replacement than do community college districts, (3) categorical support of vocational programs should be continued, (4) strong consideration should be given to additional financing for industrial arts services, and (5) more efficient program weighting factors are needed because they are neither sufficiently sensitive to local needs nor precise enough to be used in a state vocational fund's allocation system.

Harris and O'Fallon (1973) analyzed delivery costs per student contact hour for secondary vocational-technical education in Tennessee. Data were collected from a sample of six selected schools teaching 58 courses in 109 separate classes and analyzed to determine direct and indirect costs per student contact hour for each course with and without consideration of site value, total cost per student contact hour per course, total cost of educating a student in each course, and projections of course and program costs for a five year period. The results indicated no evidence that size of school or geographical location was important in determining the cost level, but teachers' salaries were found to be the largest direct cost.

Cost-Benefit Studies

From the economic perspective of vocational programs, cost-benefit studies are attempted to determine (1) average and/or marginal costs and benefits, and (2) both internal rates of return and net present values of

vocational programs. Stromsdorfer (1972) reviewed seven cost-benefit studies of secondary vocational-technical education, which have been done by (1) Eninger (1965); (2) Kaufman and Lewis (1968); (3) Corazzini (1968); (4) Taussig (1968); (5) Hu, et al (1969), and (6) Fernbach and Somers (1970). The studies revealed different magnitudes in the results. In comparison with comprehensive or academic programs, for example, average benefits ranged from 312 dollars to 667 dollars for vocational programs and rate of return to vocational programs ranged from 4.1 percent at lowest to 34.5 percent at highest (pp. 50-51). These different magnitudes appeared by program special area and resulted from different methodologies used in the studies. Through the review, it is suggested that "secondary vocational-technical graduates as a group do better (earn more) than academic or comprehensive high school graduates . . . but not all occupational specialties in vocational-technical education pay off equally well" (p. 69).

Cost-Effectiveness Studies

Cost-effectiveness studies are more complicated than cost-benefit studies by adding non-monetary and non-economic effects to monetary benefits. Hu, et al (1969) analyzed non-economic benefits such as voting behavior, career satisfaction, and economic aspiration of academic and vocational high school graduates, in addition to the analysis of economic benefits. While they found significant differences in economic benefits between vocational-technical and other curricula, no statistical evidence was found for differential levels of non-monetary benefits. As a result, they assumed that "the economic benefits as measured may represent a fairly

close estimate of total monetary and non-economic benefit" (p. 236). A cost-effectiveness analysis of the vocational education program in Puerto Rico (1971) concentrated on measures of benefit-cost ratio by programs, and by selected occupations, districts, and schools, with minor consideration of non-monetary benefits such as lowering the crime rate and reducing government expenditures for law enforcement, housing, and welfare.

Molnar (1973) attempted to assess costs and effectiveness of selected cooperative vocational education programs as compared with non-cooperative vocational programs. Data from 12 school districts selected from three states (Minnesota, North Carolina, and Ohio) for the 1969-70 and 1970-71 school years were used to explore the feasibility of conducting such a cost-effectiveness analysis. His effort was focused upon the comparison of cost per student or cost per student hour for the program area, and effectiveness as measured by follow-up information, but no attempt was made to determine the relationship between cost and effectiveness measures. Even though there were no obvious differences in the costs or in the graduates' performances between the two programs, cost-effectiveness analyses were proved to be useful for policy formulation concerning vocational education methodologies.

Some dissertation studies attempted to develop procedural models for instructional cost-effectiveness analysis. For a cost-effectiveness evaluation of occupational education, Burgett (1970) developed a procedural model which consists of six steps: (1) objectives, (2) behaviors, (3) measurement, (4) collection, (5) analysis, and (6) appraisals (pp. 34-52). As a methodological guide to the cost-effectiveness evaluation of instructional programs (K-12) at the school center level, a conceptual design

was developed by Lovell (1971). The design includes various input models, a process model, and several output (effectiveness) models. Using the basic components of an administrative system as the conceptual framework, Cary (1972) developed an operational cost-effectiveness model for instructional activities. The model is in the form of a systems manual that employs narrative and graphic modes to describe the decision-making system related to instructional cost-effectiveness analysis. The manual includes (1) policy statements that provide guidelines for operating the decision-making system, (2) an illustrative organizational chart, (3) a flow chart indicating the sequence and relationship of activities, (4) flowscript procedures, (5) job outlines for unique personnel procedures, and (6) supplementary narrative and appendix materials (pp. 69-70).

As reviewed above, more research efforts were given to cost analysis or cost-benefit analysis, rather than cost-effectiveness analysis of secondary vocational programs. Little consideration was paid to the measure of program effectiveness and its relationship to the program cost. No attempt appeared to develop a conceptual framework or model, explaining the relationship between effectiveness measures and costs of vocational programs. Some dissertation studies attempted to develop instructional cost-effectiveness evaluation models, but their efforts were limited to the conceptualization of analytical procedures or operation of cost-effectiveness evaluation of instructional activities. To increase the efficacy of a cost-effectiveness technique, it may require a deliberate effort to develop a technically useful model for explaining the cost and effectiveness relationship on the basis of the clear-cut concept of cost-effectiveness analysis in evaluating and planning vocational programs.

SUMMARY

Cost-effectiveness analysis is defined as an analytical tool for assessing outcomes of operating and/or alternative programs in achieving specified objectives as related to costs. The review of related literature identified eight elements for cost-effectiveness analysis: (1) the program(s); (2) the program objective(s); (3) the cost; (4) the output; (5) a model; (6) effectiveness; (7) efficiency, and (8) a ratio. By concentrating on the measure of goal attainments of vocational programs against the costs, cost-effectiveness analysis is operationally distinguished from cost-benefit analysis, but related to PPBS. As an analytical technique, cost-effectiveness analysis could increase the potential of the PPB system by providing decision-makers with cost implications and program effectiveness in achieving the stated objectives.

Cost-effectiveness analyses of vocational programs can be used as a means to secure optimization of resource allocation and utilization. As a method for program evaluation, cost-effectiveness analysis may be used in developing new programs as well as in evaluating existing vocational programs. For program planning purposes, the analysis is needed to maximize the effectiveness with which a given amount of resources is utilized or to produce the same level of effectiveness at the lowest possible cost. Furthermore, as the demand and support for vocational programs increases, so does the need for cost-effectiveness analyses of the programs to secure public support by providing useful information gained from the analyses.

During the past decade, research studies on cost-effectiveness analyses of secondary vocational programs appeared under contracts with

the U.S. Office of Education. Most efforts were, however, given to cost analysis or cost-benefit studies, rather than cost-effectiveness studies. Some dissertations attempted to develop cost-effectiveness evaluation models, but their efforts were limited to the conceptualization of analytical procedure for cost-effectiveness evaluation of instructional activities.

CHAPTER III

A Cost-Effectiveness Analysis Model

A conceptual model was developed for use in analyzing cost-effectiveness of secondary vocational programs. Also, a standard procedure for using the model was developed along with data requirements and instruments needed for the model.

COST-EFFECTIVENESS MODEL AND SPECIFICATIONS

After reviewing three previously developed cost-effectiveness models, a conceptual model was developed for the project. A deliberate effort was then made to specify each component and measure involved in the model.

Cost-Effectiveness Models

As mentioned earlier, no attempt has been made to develop a conceptual model for the analysis of cost-effectiveness relationships except the sophisticated works done by Abt (1969) and Alkin (1970). They illustrate an overall model and specific components and their relationships within the input-output framework.

Abt and his associates (1969) developed an education system cost-effectiveness model designed to evaluate the relative school, student, and community effects and associated costs of alternative 1965 Title I programs for the disadvantaged. Since such programs are directed toward

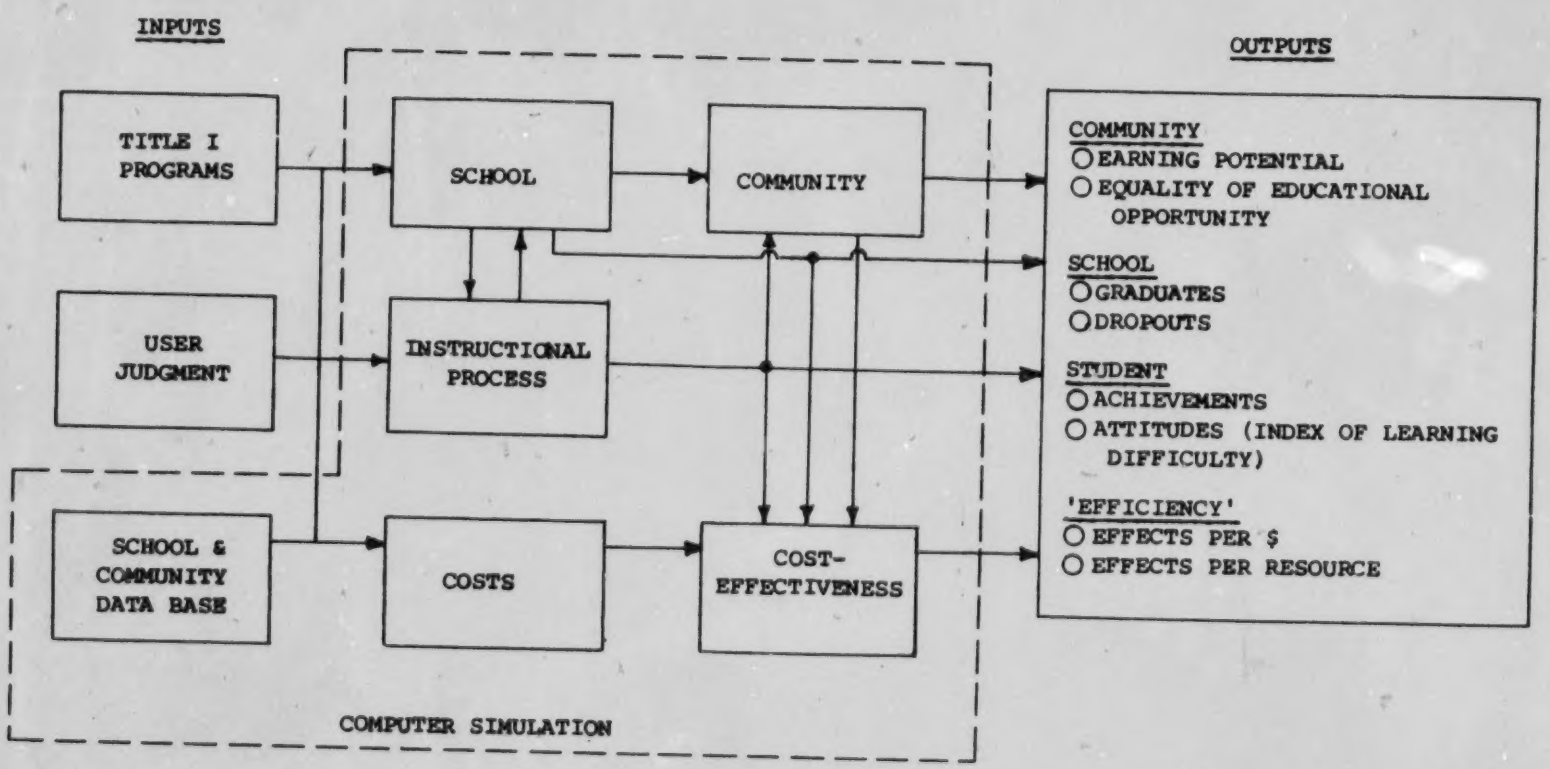

Figure 1

Abt's Cost-Effectiveness Model Overview
Showing Inputs, 5 Submodels, and Outputs.

From: Clark C. Abt, "Design for an Education System Cost-Effectiveness Model," in OECD, EFFICIENCY IN RESOURCE UTILIZATION IN EDUCATION (Paris: OECD, 1969), p. 67.

increasing learning, the model focuses on the changes in student achievement and the attitudes and environmental factors influencing achievement in the target population (p. 65). The overall model consists of five submodels: (1) school, (2) instructional process, (3) community interactions, (4) costs, and (5) cost-effectiveness. Title I programs, user judgements, and school and community data base are considered as inputs. The outputs include (1) earning potential and equality of educational opportunity for community, (2) graduates and dropouts within school, achievements and attitudes of student, and (3) specific efficiency measures such as effects per cost and effects per resource. The measure of the outputs is to be made on a before-and-after-the-project basis (See Figure 1).

Alkin (1970) proposed a model for evaluating cost-effectiveness of instructional programs with prime consideration given to financial variables in education, specifically where a single school or school district is the unit of analysis. The model includes five components of (1) student inputs referring to the nature and characteristics of the students entering the program, (2) financial inputs as the financial resources made available for carrying on the program, (3) manipulative characteristics of the way in which financial inputs are utilized within the program in combination with the student inputs, (4) outputs, referring to both the cognitive and non-cognitive changes and the impact of the program upon systems external to it, and (5) external systems, including the social, political, legal, economic, and other systems outside the school (See Figure 2).

Assuming that his model is static and both the external system and the student inputs are non-manipulatable, Alkin concerned himself

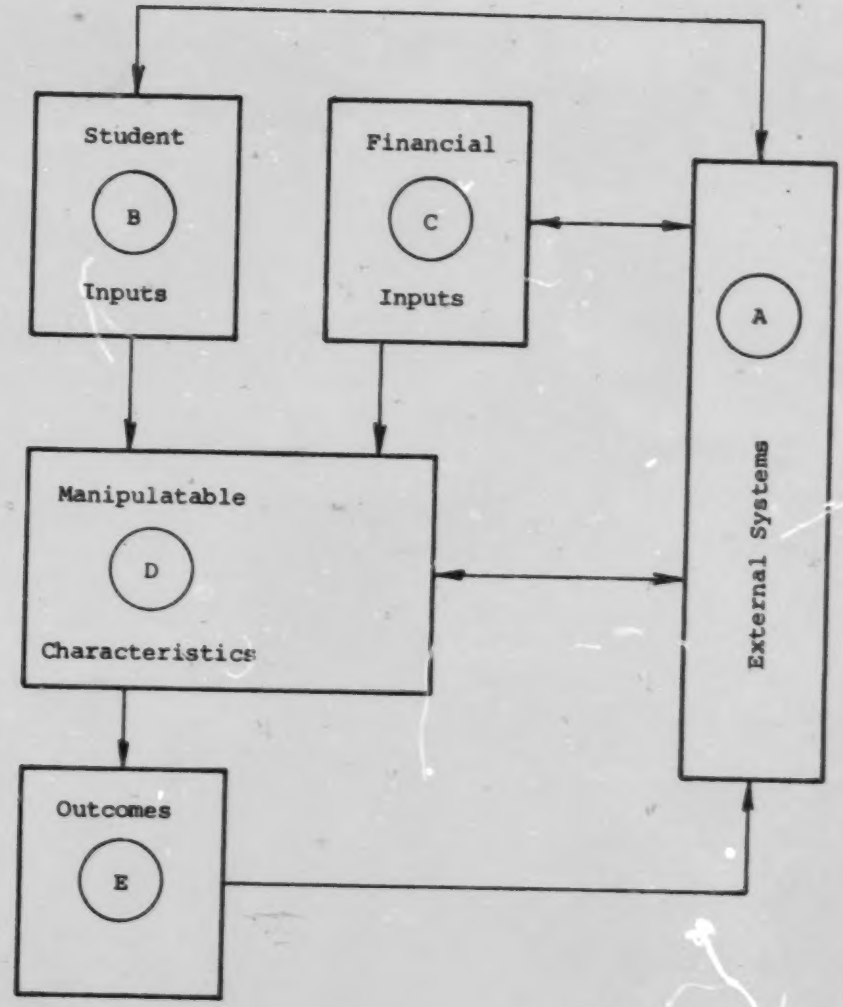

Figure 2

Alkin's Cost-Effectiveness Model

From: Marvin C. Alkin, "Evaluating the Cost-Effectiveness of Instructional Programs," in M. C. Wittrock & David E. Wiley, ed., THE EVALUATION OF INSTRUCTION: ISSUES AND PROBLEMS (New York: Holt, Rinehart and Winston, Inc., 1970), p. 226.

with the manipulatable variables within the system that can be managed to maximize student outputs. Finally he illustrated three examples of the application of the model: (1) evaluating the cost-effectiveness of alternative instructional programs in terms of the financial resource and student outcome relationship; (2) evaluating the cost-effectiveness of individual school programs in the light of outcomes relating to external systems, financial and student inputs, and (3) evaluating cost-effectiveness of input utilization options relating manipulatable characteristics with outcomes. Thus, Alkin's model specifies the input-outcomes relationships among the five components.

Aside from these two models, a conceptual framework for economic analysis of education is being developed at the Wisconsin R & D Center for Cognitive Learning. The framework includes (1) resource inputs to the educational system from the external environment; (2) components of the educational system, consisting of system inputs and resource input mix(es); (3) the system outputs -- monetary and non-monetary and (4) feedback as the self-correcting mechanism for the system (Rossmiller & Geske, 1976). Based on the systems analysis scheme, the framework indicates the relationships among the educational system's parts and between the system and its environment.

These models would be useful for research studies on the input and output relationships among the components of the educational system, but they are far from being practical in analyzing the cost-effectiveness relationship of education programs. These models also lack the specification of the "objective" dimension and "effectiveness" as a measure of the relationship between the objective and the associated output. The

essence of the cost-effectiveness analysis method is, according to Quade (1967), to construct and operate within a model which introduces "a precise structure and terminology that serves primarily as a means of communication, enabling the participants in the study to make their judgements in a concrete context" (p. 4).

As early as 1959, Kershaw and McKean proposed the use of systems analysis in education to assess the possibilities of making quantitative comparisons of educational systems. Before the comparisons could be made, they stressed the need for the development of the models and/or relationships required to estimate all costs, alternative processes and output measures (p. 1). Also, Knezevich (1973) emphasized that cost-effectiveness analysis should include a continuous cycle of activities based on defining objectives, designing alternatives to achieve objectives, evaluating alternatives on a systematic basis, and using models of units under study and quantitative analysis techniques (p. 330). To make it possible to assess cost-effectiveness measures, research effort was given to developing a cost-effectiveness analysis model for secondary vocational programs.

A Cost-Effectiveness Model for Secondary Vocational Programs

In analyzing cost-effectiveness of secondary vocational programs, a conceptual model was developed by a simplified representation of the relationships among the major components: (1) vocational programs, (2) program objectives, (3) costs, and (4) outputs. The primary effort was focused upon generating three measures indicating (1) program effectiveness, (2) efficiency, and (3) a cost-effectiveness and performance ratio. The proposed model involves both student characteristics and community

demand and support as inputs to the school system. Economic and non-economic benefits for the community are implied by the long-term results of the school system.

While an overall framework showing four major components, three cost-effectiveness measures, student and community inputs and long-term outputs of the school system is illustrated in Figure 3, three kinds of cost-effectiveness measures are conceptualized in relationship to the four conponents as shown in Figure 4. Effectiveness is measured by the relationship between planned program objective/goals and actual outputs, efficiency is measured by the unit cost concept and indexed by the division of actual expended unit cost over budgeted unit cost. Finally a cost-effectiveness ratio is computed by dividing effectiveness index by the unit cost in a somewhat different way from the commonly used method that is the division of outcomes by actual expended cost. Performance ratio is derived from the division of effectiveness index over efficiency index. Specifications of each of the components and measures follow.

Vocational Programs. The proposed model is directed toward analyzing cost-effectiveness of the secondary vocational program, which is distinguished from the academic counterpart of the program at the senior high school level. The vocational program includes seven program areas: (1) agriculture, (2) distribution, (3) health, (4) home economics, (5) business and office, (6) technical education, and (7) trade and industry. Each of the vocational program areas is classified into the sub-programs or courses as appeared in the Indiana State Plan (1975, pp. 52-55), based on the classification of the U.S. Office of Education (See Appendix A).

Within the model, the vocational sub-program areas or courses are

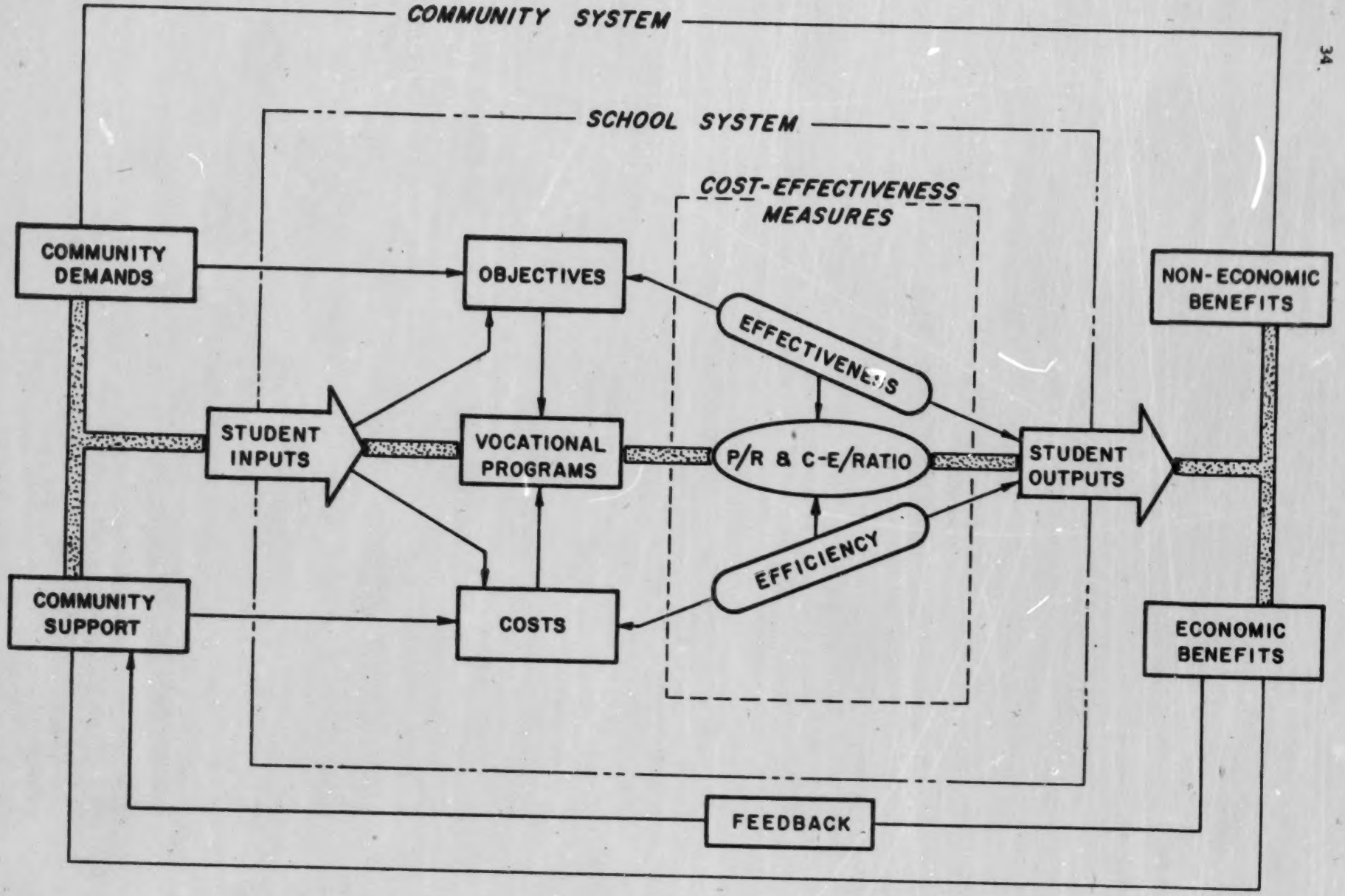

FIGURE 3

THE COST-EFFECTIVENESS ANALYSIS MODEL
FOR SECONDARY VOCATIONAL PROGRAMS

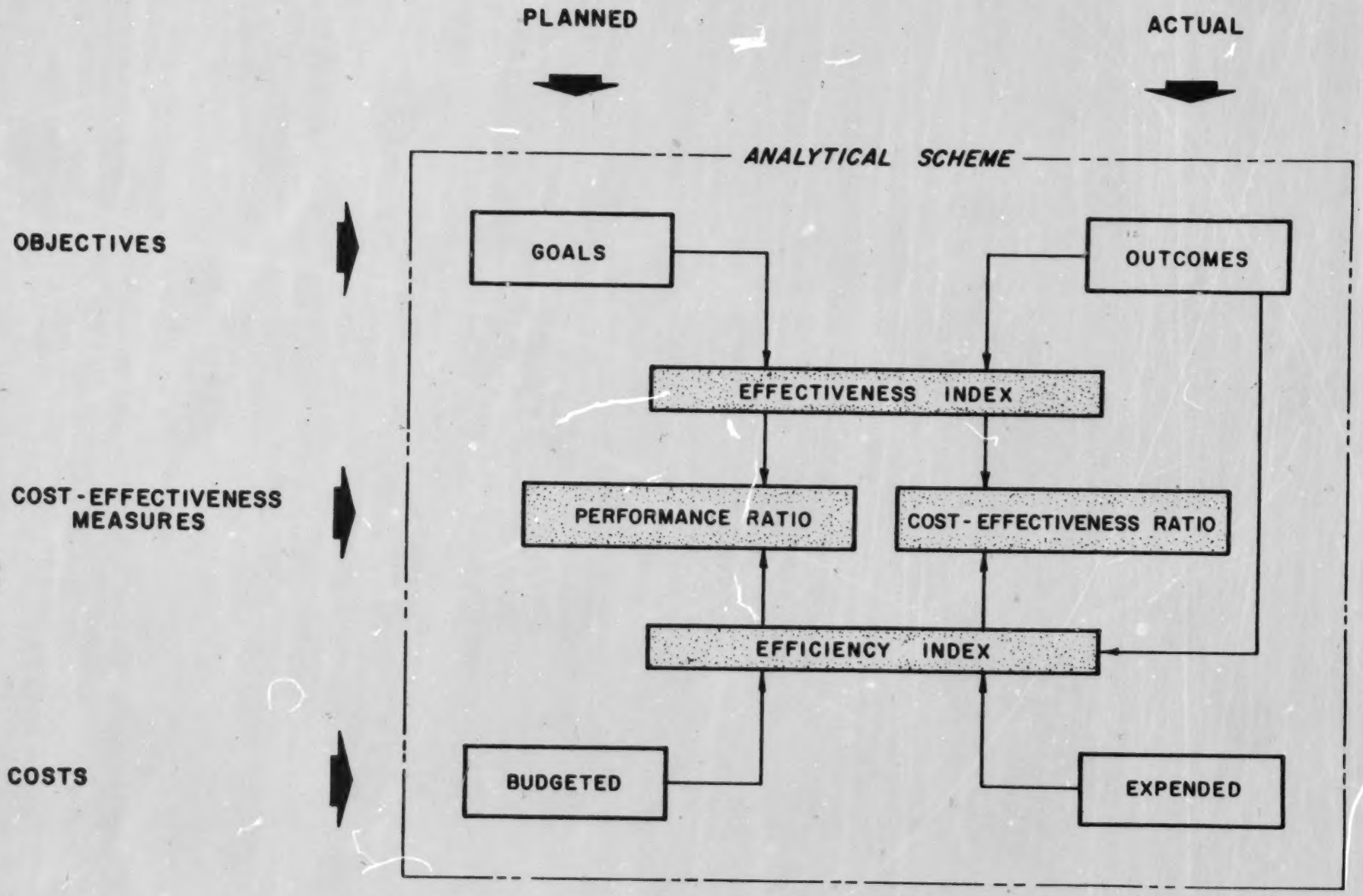

FIGURE 4

ANALYTICAL SCHEME FOR COST-EFFECTIVENESS MEASURES

defined as "instructional programs" to be basic units of analysis. In other words, the proposed model is concerned with cost-effectiveness analyses of vocational instructional programs, such as "agricultural production" or "agricultural mechanics," within the agriculture program area.

Program Objectives. Program objectives are defined by specified target goals to be attained from the vocational instructional programs as offered at comprehensive high schools or area vocational schools. The model requires that a set of program objectives be formulated by the operating thrusts of vocational administrators at the local school district. Program objectives at this level would be based on the state goals and objectives. However, there may be differences in the local community demands and student characteristics by district. Therefore, they should reflect the program needs and requirements of the local district as well as statewide goals and objectives.

It is also assumed that program objectives will be product-oriented and performance objectives. The model requires that program objectives be related to outcomes anticipated from the program in the local district. Furthermore, program objectives should be subdivided into targeted goals which are expressed in measurable terms related to degrees of attainment within the instructional program.

Under these assumptions, a set of program objectives is identified for the project. A review of six related documents (Swanson, 1971; Coe, 1971; Starr, 1970; Indiana State Plan, 1975; Multi-State project, 1971; and Burgett, 1970) provided sources for a summary of seven objectives of the secondary vocational instructional program. They are stated as follows:

1. Aid students enrolled in vocational education to successfully complete a secondary occupational program.

2. Assist special student groups to successfully achieve in a secondary vocational program.

3. Provide vocational education for secondary school youth in accordance with their occupational preparation.

4. Provide leadership development activities for students enrolled in vocational programs through a youth organization functioning as an integral part of the vocational instruction.

5. Provide guidance and counseling services (career development) information appropriate to continued education or employment for students enrolled in vocational programs.

6. Provide vocational programs to fulfill the requirement of the labor markets and the employment community manpower needs.

7. Encourage vocational graduates to continue their education after completion of their secondary program.

Each of these program objectives is described in measurable terms as to degrees of its attainment. For example, objective one includes a number of target goals indicating how many (or what percentage) of students enrolled in the vocational instructional program will complete the program and the degree of satisfaction with the program (See Appendix B).

Program Costs. Program costs are defined as annual expenditures for operating the vocational instructional program at the local school corporation (district) level. Since the model is basically concerned with the school corporation's expenditures for the operation of the vocational instructional program, foregone income and the time of students while they are in the program, is not included in the model. Expenditures are to be analyzed on one-year basis without consideration of the present value of a multi-year cost. Program costs may be divided into direct and indirect

costs as recommended by the U.S. Office of Education (Handbook II, 1973).

Direct costs of a vocational instructional program can be defined as expenditures directly related to the instructional program. The expenditures are classified as (1) salaries, (2) employee benefits, (3) purchased services, (4) supplies and materials, (5) capital outlay, and (6) others (pp. 23-24). Following this classification, in the model, the following six items are included as direct costs of the instructional program:

1. Annual salaries of teaching staff within the vocational instructional program.
2. Fringe benefits paid by the school corporation in behalf of teaching staff within the program.
3. Travel costs for instruction related to the program.
4. Costs of instructional supplies and materials used by the program.
5. Costs of classroom and laboratory facilities and equipment used by the program.
6. Building use cost assigned the program.

Prorated expenditures for supporting services are considered as indirect costs of the instructional program. The supporting services include (Handbook II, pp. 39-48):

1. Student support services: Activities which are designed to assess and improve the well-being of students and supplement the teaching process.
2. Instructional staff services: Activities associated with assisting the instructional staff in the teaching process.
3. General administration services: Activities concerned with establishing and administering policy in connection with operating the school corporation (district).
4. School administration services: Activities concerned with overall administrative responsibility for school operation.

5. Business services: Activities concerned with purchasing, paying, transporting, exchanging, and maintaining goods and services for the school corporation.

6. Central support services: Activities, other than general administration and business services, which support each of the other instructional and supporting services.

Expenditures for these supporting services should be prorated to each of the instructional programs on the basis of appropriate criteria. For proration purposes, the Handbook II illustrates applicable bases. They are: (1) time, (2) average daily membership or pupils enrolled, (3) time space, (4) time consumption, (5) number of pupils, (6) mileage, (7) units consumed, (8) employees, (9) number of transactions, or (10) dollars (p. 82). The selection of one basis over another would depend on the types of supporting services. For analytical purposes, a simplified method was developed to prorate supporting service expenditures between instructional programs. As shown in Table I, expenditures for student services can be prorated on the basis of average daily membership (ADM), and instructional staff services expenditures can be prorated by full-time equivalent teachers. Expenditures for general administration and school administration services can be prorated by full-time equivalent teachers or ADM. Both instruction hours and square feet of space can be used in prorating expenditures for plant operation and maintenance, ADM for pupil transportation and food service expenditures, and full-time equivalent teachers for fiscal and internal business service expenditures. Central services expenditures can be prorated by ADM or full-time equivalent teachers. Specific analytical methods will be explained in "Analytical Forms" later.

Program Outputs. According to the National Center for Educational

TABLE I

BASES FOR PRORATING EXPENDITURES FOR
SUPPORTING SERVICES BETWEEN INSTRUCTIONAL PROGRAMS

Expenditure Accounts	Average Daily Membership	Full Time Equivalent Teachers	Instruction Hours	Square Feet Space
Student Services	X			
Instructional Staff Services		X		
General Administration Services	O	X		
School Administration Services	X	O		
Business Services				
. Operation and maintenance of plant			X	X
. Pupil transportation and food service	X			
. Fiscal and internal services		X		
Central Services				
. Planning, research, and staff services		X		
. Statistical and data processing services	X			

X indicates: preferred method
O indicates: alternative method

Statistics (1973), fifty-eight different educational outcomes are classified into a series of three phases: (1) primary effects (product consumption and investment, (2) secondary effects (investment and consumption feedback), and (3) tertiary effects (intergenerational impacts). Clemmer, et al (1974)

identified performance indicators including student test results and number of students completing graduation requirements and societal indicators including employment rate of recent graduates (p. 3). However, program outputs are defined, in the model, by attainment of predetermined objectives as desired outcomes resulted from vocational instructional programs. Accordingly, the scope and contents of the program outputs are determined by a set of program objectives, and output indicators provide bases for measuring program effectiveness and cost efficiency.

Effectiveness Measures. Three numerical measures are expected from the model. First, effectiveness is defined as "a measure of the achievement of program objectives" (Forbes, 1974, p. 21). Program effectiveness in the model is measured by the degree of target goal attainment, the extent to which the goal is achieved.

Effectiveness score is computed by dividing the actual output by the expected target goal. For example, if 100 percent of the enrollees were expected to complete a program, but 90 percent actually completed the program, effectiveness score of the program indicates a 90 percent.

Furthermore, a number of effectiveness scores can be combined into an effectiveness index. A composite effectiveness index is made by adding all available effectiveness scores. Dividing a composite index by the number of scores provides an average effectiveness index. If effectiveness scores are differentially weighted by the priority of objectives, a weighted, composite, and average effectiveness index can be made using the same procedure.

Efficiency Measures. Second, efficiency is measured by the cost and output relationships which result in unit costs. In general, unit cost

is computed to indicate "resources consumed for a unit of output" (Knezevich, 1973, p. 162). The proposed model attempts to compute unit costs as efficiency measures by dividing total costs of the program by units of the outputs, such as total number of program completions or graduates. Unit costs per student and per student contact hour can be made by dividing annual total costs of the instructional program by total number of students enrolled in the program and by total number of student contact hours within the program (Molnar, 1973; Harris & O'Fallon, 1974).

If budgeted costs were analyzed for the vocational program, a cost efficiency index could be made by the computation of actual unit cost over budgeted unit cost for the vocational instructional program. The cost efficiency index indicates more or less than one unit.

Cost-Effectiveness Ratio and Performance Ratio. The ultimate product of the model is to compute a meaningful cost-effectiveness ratio and a performance ratio. A cost-effectiveness ratio results from the computation of program effectiveness measures over unit costs as efficiency measures. It indicates the degree of goal attainments per unit cost.

As a result, the definition of a cost-effectiveness ratio would be somewhat different from a commonly used concept, which is determined by dividing outputs by the costs as inputs (Knezevich, 1973, p. 204; Handbook II, 1973, pl 70). The cost-effectiveness concept is lacking effectiveness measures and may be referred to as a cost-output ratio rather than a cost-effectiveness ratio.

The performance ratio is generated from division of program effectiveness index by cost efficiency index. The performance ratio, as defined in the model, is no more than a precise index representing both program

effectiveness and cost efficiency together. Therefore, the ratio should be interpreted along with both effectiveness and efficiency implications in evaluating the vocational instructional program.

Student Characteristics. The proposed model includes student characteristics data as input to the school system, especially in relation to determining program objectives and cost. The U.S. Office of Education suggests a classification of student characteristics into two categories: (1) regular students and (2) special students who are gifted and talented, mentally retarded, physically handicapped, emotionally disturbed, or culturally disadvantaged (Handbook II, 1973, p. 24). In addition to such characteristics, the model suggests proxy measures of student inputs, including (1) students' sex, age, and ethnic identity; (2) individual needs for vocational education and achievement scores, and (3) the socio-economic status of a student's family such as parents' education and annual income. These student input data are related to the specification of program objectives and will be used in interpreting student outputs and the results from cost-effectiveness analyses.

Community Demand and Support. As external factors to the school system, community demand and support for secondary vocational programs are included in the model. Community demand identifies population trends, mobility of residents, and manpower needs. The level of economic resources and willingness to support a school system determine the amount and quality of human and material resources which may operate the system's vocational programs. These community resources and support would be measured by an average income level and distribution among the residents, and tax rate for education and/or voting behavior on educational bonds for vocational

programs.

Economic and Non-Economic Benefits. Conceptually concerned with long-range outputs of the school system, the model suggests the consideration of the effect of schooling on economic benefits such as earnings, employment and occupational improvements. It also suggests that non-economic benefits of long-range outputs be measured by the degree of "participation in governmental affairs, crime rates, and number of public assistance recipients" (Rossmiller & Geske, 1976, p. 500).

Feedback. The final consideration of the cost-effectiveness analysis model is the feedback loop and input-output relationship in operating vocational programs. As a self-correcting mechanism, feedback relates educational effects to community demand and support for the evaluation and planning of vocational programs. Programs also can be evaluated within the input-output relationship by measuring changes in students before-after program operation at the school level and/or by assessing community-wide input-output relationships for the program operation.

As mentioned above, the proposed model consists of four major components, three measures, three additional factors, and feedback. Basically concerned with drawing three cost-effectiveness measures, however, primary effort will be given to developing data types, instruments and analytical forms for the first four major components within the model.

DATA INSTRUMENTS AND FORMS

The implementation of cost-effectiveness analysis requires appropriate data pertaining to each of the components. The specified data types provide a base for developing data collection instruments and analytical forms.

Data Types

Data types are specified for cost-effectiveness analysis of secondary vocational programs. Data are identified as program objectives and outputs, costs, and student and community characteristics.

Data for Program Objectives and Outputs. The proposed model is directed toward evaluating cost-effectiveness of vocational programs at the secondary school level. Evaluation of the program objectives and outputs will require data on enrollees and completions from the vocational instructional program, academic achievement, and follow-up information on employment and advanced studies after graduation.

With regard to Objective One, as specified in the model, data will be required on enrollment, program completion, graduation, dropouts, and satisfaction of students with the program(s) completed. For Objective Two, data will be required on special student groups relative to enrollment, completions, and program satisfaction. Follow-up data on employment of graduates and satisfaction with occupational preparation and the job in relation to the program will be needed for Objective Three. For Objective Four, records on student participation in leadership development activities and satisfaction with the participation will be required. Data on guidance and counseling services and career development information as provided to students will be required to meet Objective Five. For Objective Six, data will be required on graduates' employment within and outside the community which the school serves, community manpower demands information, and employers' opinion on vocational training of employees. Finally, for Objective Seven, data on graduates' advanced studies at post-secondary institutions will be required.

In conjunction with the objective data, actual attainment records and information will be needed for identifying output indicators of the program. Data on both the objectives and outputs will be required in measuring program effectiveness.

Data for Costs. Program costs include both direct instructional costs and indirect supporting services costs. Direct costs will be concerned with those expenditures related to providing instructional services, such as salaries and fringe benefits of the teaching staff, travel expenses, instructional supplies and materials, classroom and laboratory facilities and equipment, and building costs.

The determination of indirect supporting services costs will require broader information on expenditures for supporting services and allocation bases which may be used for prorating indirect costs to the direct cost of vocational instructional programs. Indirect costs will be those expenditures incurred in supporting instructional activities, such as pupil services, instructional staff services, general administration, school administration, business services, and central services. For allocation purposes the following data will be needed; (1) average daily attendance or average daily membership, (2) number of student contact hours, (3) number of full-time equivalent teachers, and (4) square feet of building space for the instruction.

Cost data are classified according to the accounting system recommended by the U.S. Office of Education, which is also adapted to the State of Indiana. The quantity of cost data to be collected for a cost-effectiveness analysis may vary with decision situations from a minimum of the direct assignable program operational costs to a maximum effort for

collection of all capital and operating costs of the school system. When evaluating an individual vocational program or comparing more than two programs within a school, it may not be necessary to consider capital outlays. However, if the cost-effectiveness is to be used in making decisions pertaining to comparison of vocational programs among schools, or selection of new programs which may need new facility acquisitions, then capital costs must be considered. Thus the amount of cost data required will be a function of the decision situations as well as the purposes of the cost-effectiveness analysis.

Data for Student and Community Characteristics. As the program's target population, student characteristics data will be required not only for determining the program objectives, but also for interpreting the analytical results. Student characteristics data include personal data such as age, sex, previous vocational training, educational goals, attitude toward school, job experience before school, and future job expectations; and family background including parents' race, educational level, expectation of children's education, and job and income level. For programs which serve a small target population, it may be desirable to collect characteristics data on all students. In other cases, especially for follow-up information, a sample of students would be sufficient for an analysis.

Data on community characteristics external to the school system will be needed for the design and operation of the program. Identifiable characteristics of the community within which a vocational program operates are, for example, community demands and financial support for vocational education. The sources of data concerning community demands for vocational

education include population characteristics such as annual growth, age distribution, sex and ethnic group ratios and employment data about the size of the labor force, unemployment ratio, and manpower demand projections. On the other hand, financial support for vocational education can be measured: (1) by the family income level and the extent of revenue along with tax rates, (2) by changes in the level of support over a period of time with consideration of inflationary factors, and (3) by approval of bonds issued by the school corporation for the support of vocational education programs.

Both student and community characteristics data may not be considered in cost-effectiveness analysis as far as the analytical technique is concerned with the cost and effectiveness aspects of the instructional program. As previously indicated, however, it would be unwise to set forth program objectives without the student and community characteristics data base.

Data Collection Instruments

The data types identified have been combined into a set of five data collection instruments, which are attached as Appendix C. Some previously developed instruments for use in collecting student and community characteristics data were suggested.

School Corporation (District) Information (I). The instrument was designed to collect general information on total number of average daily membership, school hours, student contact hours, full-time equivalent teachers, and building space for instruction as a whole.

Secondary Vocational Instructional Program Data (II). Instructional program data were focused upon student enrollments and completions, student

participation in youth organizations and ancillary services.

Students' Follow-up Program Rating Scale (III). The questionnaire was developed for the graduates to rate the vocational instructional program which had been completed. Primary attention was directed toward satisfaction with vocational training, job preparation, present job, youth organization activities, ancillary services, and/or preparation for advanced studies.

Employers' Opinion on Vocational Training of Employees (IV). The questionnaire was designed to explore employers' opinions about the skill, knowledge and abilities of employees who completed the vocational training program, as well as employment policies dealing with employees trained in vocational programs.

Vocational Instructional Program Cost Data (V). Total budget and expenditures incurred in instruction and supporting services of the school corporation can be collected according to the accounting system recommended by the U.S. Office of Education (Handbook II). If the school corporation does not adopt this accounting system, careful consideration has to be given to assigning appropriate cost items to instruction and supporting service categories. Instructional direct cost items of a vocational instructional program include salaries and fringe benefits of teaching staff, travel expenses for instruction, instructional supplies and material costs, classroom furniture and laboratory equipment costs, and building use costs for instructional purposes. Indirect supporting services costs include total expenditures for (1) student services, (2) instructional staff services, (3) general administration, (4) school administrations, (5) business services, and (6) central services, as provided by the school corporation.

Student and Community Characteristics Data. Student characteristics

data can be collected, using the high school student's questionnaire published by the Department of Health, Education, and Welfare (Thompson, 1974). Following social indicator forms developed by the Executive Office of the President (1973), community characteristics information may be collected. The student and community characteristics data were not directly related to cost-effectiveness analysis, but it was suggested that the data be used in determining program objectives and interpreting the analytical results from the cost-effectiveness study.

Analytical Forms and Techniques

Vocational instructional program and follow-up data will be analyzed for identifying program target goals and associated outputs to determine program effectiveness measures. Cost data will be treated to identify direct instructional costs and indirect supporting services costs of a vocational program. Specific analytical forms and techniques were developed for (1) program effectiveness analysis, (2) program cost analysis, and (3) cost-effectiveness measures.

Program Effectiveness Analysis. First, a program objective and output data unit is identified by factor unit over basic unit of the specific target goal. For instance, the target goal of Object 1-b can be set forth by dividing number of students who are expected to complete (factor unit) by number of students enrolled (basic unit) and multiplying the result one hundred times as illustrated in Table II.

TABLE II

AN ILLUSTRATION OF PROGRAM OBJECTIVES
AND OUTPUT DATA UNIT

Objective 1-b	Basic Unit	Factor Unit	Target Goal
___ percent of the students will complete the program requirements	Number of students enrolled	Number of students to complete	$\frac{\text{Factor Unit}}{\text{Basic Unit}} \times 100 = ___\%$

Second, the target goal of Objective 1-b is compared with the actual output to identify the degree of goal attainment, that is, a program effectiveness score. The program effectiveness analysis procedure is illustrated in Table III. Effectiveness score is measured by a percent of actual output over the target goal. The score, if necessary, can be weighted as compared with other goal statements, then it will be adjusted to a weighted value.

Furthermore, if there are two or more effectiveness scores, all effectiveness scores can be combined into a composite effectiveness index. Dividing the composite effectiveness index by number of scores will produce an average effectiveness index. If the effectiveness scores are weighted, then a weighted composite effectiveness index and weighted average effectiveness index can be computed in the same way.

TABLE III

AN ILLUSTRATION OF PROGRAM EFFECTIVENESS ANALYSIS

Objective 1-b	Target Goal	Actual Output	Effectiveness Score	Weighted Value: Weight	Weighted Value: Adjusted score
___ percent of the students will complete the proper requirements	___	___	$\frac{\text{Actual}}{\text{Targeted}} \times 100$ = _____	X _____	= _____

Cost Analysis. A total cost of a vocational instructional program is computed by direct costs of instruction plus supporting services indirect costs prorated to the program. First, direct costs of instruction include the following items:

1. Annual salaries of teaching staff within the instructional program. Actual annual salaries of teaching staff, including substitute and temporary teachers, are assigned to the instructional program. A total of salaries assigned to the program can be computed on the basis of teaching time alloted to a given instructional program, using the following formula:

$$AAS = \sum_{n=1}^{n} S_i \cdot T_i \ (\%)$$

Where, AAS: Actual Annual Salaries of teaching staff
S_i: Annual salary of individual teacher
T_i: % of teaching time alloted to a given program

An alternative method is to multiply average annual salaries of all vocational teachers by full-time equivalent teachers (FTE) within the instruc-

tional program. An average annual salary is equal to the amount generated from total annual salaries of all vocational teachers over total of full-time equivalent teachers. Accordingly, actual annual salaries paid for the program are expressed by:

$$AAS = fte \cdot \frac{TS}{FTE} \text{ (or Average Salary)}$$

Where, AAS: Actual annual salaries of teaching staff
fte: Full-time equivalent teachers within the program
TS: Total of annual salaries of all vocational teachers
FTE: Total of full-time equivalent vocational teachers

2. Fringe benefits for teaching staff within the instructional program. Fringe benefits of teaching staff are accounted for by certain amounts of the fringe benefits paid by the school corporation in behalf of teaching staff within the program. Two methods are available in computing the amount of fringe benefits. The first method is to add actual amounts paid by the school corporation for retirement contribution, health and/or life insurances of teaching staff, and other benefits. A total of fringe benefits paid by the school corporation is computed by:

$$FB = \sum_{i=1}^{n} (RC_i + HI_i + LI_i + O_i)$$

Where, FB: Fringe benefits assigned to the program
RC_i: Retirement contributions to individual teachers within the program
HI_i: Health insurance pensions paid for individual teachers within the program
LI_i: Life insurance pensions paid for individual teachers
O_i: Other benefits paid for individual teachers within the program

The second method is to multiply total actual salaries assigned to the program by a certain percent for fringe benefits paid by the school corporation as follows:

$$FB = AAS \cdot xP\ (\%)$$

Where, FB: Fringe benefits assigned to the program
AAS: Actual salaries of teaching staff within the program
xP(%): Certain percent of the salaries for fringe benefits

3. Travel costs for instruction. Travel costs are the annual amounts of mileage expense and per diem paid to instructors who traveled and student field trips for instructional purposes in relation to the program. A total amount of instructional travel costs is computed by:

$$TC = \sum_{i=1}^{n} [(M_i \cdot ¢/m_i) + (D_i \cdot \$/di)] + \sum_{j=1}^{n} FT_j$$

Where, TC: Travel costs for instruction
M_i: Total mileage of individual instructors
$¢/m_i$: Cents per mileage
D_i: Total travel days of individual instructors
$\$/d_i$: per diem
FT_j: Annual costs of student field trips

4. Costs of instructional supplies and materials assigned to the instructional programs. These costs are expenditures for consumable supplies and other materials for instructional purposes. If expenditures for instructional supplies and materials are allocated to all vocational programs, the expenditures should be prorated to each of the instructional programs on the basis of student contact hours. The proportion of instructional supplies and materials costs can be formulated by the following:

$$ISMC = \frac{sch}{SCH} \cdot (C)$$

Where, ISMC: Instructional supplies and material costs for a given instructional program
sch: Student contact hours for a given instructional program
SCH: Total student contact hours of the vocational program
(C): Total expenses for instructional supplies and materials for the vocational programs

5. Costs of classroom and laboratory facilities and equipment used by the instructional program. These costs are total amounts of yearly depreciated costs of classroom and laboratory facilities and equipment used by the instructional program. Depreciated costs can be estimated by dividing original cost by life expectancy. If the use of facilities and equipment is shared with other instructional programs, the annual costs should be prorated to a given program on the basis of percentage of use in the program. Actual annual costs can be computed as follows:

$$FEC = \sum_{i=1}^{n} \frac{OC_i}{Y_i} \cdot X(\%)_i$$

Where, FEC: Actual annual costs of classroom and laboratory facilities and equipment used by a given instructional program
OC_i: Original cost of items
Y_i: Life expectancy of items
$X(\%)_i$: Percentage of use of a piece of equipment for a given instructional program

6. Building use costs assigned to the instructional program. This is the cost of using a building by the instructional program for a fiscal year. The building use cost is determined by dividing the original cost by life expectancy (Handbook II, p. 168), as follows:

$$BUC = \frac{OC}{Y}$$

Where, BUC: Building use cost for a year
OC: Original cost of vocational building
Y: Life expectancy

For actual building use cost for a given instructional program, the annual cost of the vocational building should be prorated to the instructional program on the basis of percentage of space and time used for the program. Annual actual building use cost of a given program is expressed by:

$$AABUC = AC \cdot \frac{(A)}{(B)} \cdot \frac{(C)}{(D)}$$

Where, AABUC: Actual annual building use cost of the instructional program
AC: Total annual cost of vocational building
(A): Square feet of building space used by the instructional program
(B): Total square feet of vocational building space
(C): Instruction hours for a given program
(D): Total instruction hours for the vocational programs

A sum of all costs of the six items accounts for the instructional direct costs. When evaluating one program within a school or comparing two or more programs in the same school, building use cost may be excluded from the direct cost of the instructional program.

Next, supporting services indirect costs can be prorated to the instructional program through the following procedures:

1. Student support service costs prorated to the vocational instructional program. These costs include expenditures for (1) attendance and social work, (2) guidance, (3) health, (4) psychological, and (5) speech

pathology and audiology services for improving the well-being of students and supplementing the teaching process. Total amounts of expenditures for student services can be prorated to the instructional program on the basis of average daily membership (ADM), using the following formula:

$$PSSC = \frac{adm}{ADM} \cdot (C)$$

Where, PSSC: Prorated student services costs to a given program
adm: Average daily membership in the instructional program
ADM: Total average daily membership of school corporation
(C): Total expenditures for student services of school corporation

2. Instructional staff services costs prorated to the instructional program. These costs are amounts paid for those activities associated with (1) improvement of instruction and (2) educational media services for assisting the teaching staff. Total expenditures for instructional staff services of a school corporation can be prorated to the instructional program on the basis of full-time equivalent teachers by use of the following formula:

$$PISSC = \frac{fte}{FTE} \cdot (C)$$

Where, PISSC: Prorated instructional staff services costs for a given instructional program
fte: Full-time equivalent teachers for the instructional program
FTE: Total full-time equivalant teachers within school corporation
(C): Total expenditures for instructional staff services of school corporation

3. General administration services costs prorated to the instructional program. These costs are amounts paid for services concerned with

establishing and administering policy in connection with operating the school corporation, including board of education services and executive administration services. General administrative costs can be prorated to the instructional program on the basis of full-time equivalent teacher as shown in item 2, above.

4. School administration services costs prorated to the instructional program. These costs are amounts paid for services concerned with overall administrative responsibility for a school operation such as the principal's office services. School administration services costs can be prorated to the instructional program on the basis of average daily membership as shown in item 1, above.

5. Business services cost prorated to the instructional program. These costs are amounts paid for activities concerned with purchasing, transporting, and maintaining goods and services. For analytical purposes, business services costs can be categorized into (1) operation and maintenance of plant, (2) pupil transportation and food services, and (3) fiscal, and internal services for operating all schools, and can be prorated to the instructional program using a different prorating basis for each category of services.

The proration of costs for operation and maintenance of plant can be based on proportion of space and time used in the instructional program. Prorated plant operation and maintenance costs are estimated by:

$$PPOMC = \frac{(A)}{(B)} \cdot \frac{(C)}{(D)} \cdot (E)$$

Where, PPOMC: Prorated plant operation and maintenance costs for a given instructional program
(A): Square feet of building space used by the instructional program
(B): Total square feet of building space of school corporation
(C): Instruction hours for the program
(D): Total instruction hours of school corporation
(E): Total amounts paid for plant operation and maintenance of school corporation

Amounts paid for pupil transportation and food services can be prorated to the instructional program on the basis of average daily membership (ADM) as shown in item 1, above; whereas amounts paid for fiscal and internal services can be prorated to the instructional program on the basis of full-time equivalent teachers as shown in item 2, above. A total of the prorated costs of these three categories represents business services cost prorated to the instructional program.

6. Central support services costs prorated to the instructional program. These costs are amounts paid for services of (1) planning, research, evaluation, and staff services, and (2) statistical and data processing services, from the central office. For the first category of services, the number of full-time equivalent teachers can be used in prorating total amounts paid for the services to the instructional program in the same way as shown in item 2; whereas average daily membership (ADM) can be used in prorating amounts paid for the second category of services to the instructional program using the same method as shown in item 1.

After these prorating procedures are completed, the prorated costs of all supporting services are added to the supporting indirect costs of

the instructional program. The sum of direct and indirect cost represents a total cost of the vocational instructional program. Based upon the annual budget, total costs of vocational programs can be made by repeating the same procedures as mentioned above. These costs may be called budgeted total costs of vocational programs.

Finally, actual total costs of vocational programs can be analyzed to produce unit costs as efficiency measures. Unit cost per completion or graduate, per student enrolled in the program, or per student contact hour can be computed by dividing total cost of the instructional program by total number of completions or graduates, students, or student contact hours. In addition, a budgeted unit cost can be computed for the program. By dividing actual unit cost or total cost by budgeted unit cost or total cost, a cost efficiency index will be produced.

Cost-Effectiveness Measures. Procedures for computing cost-effectiveness measures are expressed by the following formulas:

First, Program Effectiveness (PE_i) scores are derived by dividing outputs (O_i) over the target goals (G_i), or

$$PE_i = \frac{O_i}{G_i} \quad \text{.....(Formula 1)}$$

A number of program effectiveness measures can be added to a Composite Program Effectiveness (CPE) index, and an Average Program Effectiveness (APE) index can be derived by dividing the composite index by a number of effectiveness scores (N). They are expressed by:

$$CPE = \sum_{i=1}^{n} \frac{O_i}{G_i} \quad \text{.....(Formula 2)}$$

$$APE = \frac{\sum_{i=1}^{n} \frac{O_i}{G_i}}{N} \quad \text{.....(Formula 3)}$$

If each program effectiveness is weighted on the basis of policy preference or importance of program objectives, then a Weighted Composite Program Effectiveness (WCPE), and a Weighted Average Program Effectiveness (WAPE) index can be made as follows:

$$WCPE = \sum_{i=1}^{n} \frac{O_i}{G_i} \cdot W_i \quad \text{.....(Formula 4)}$$

$$WAPE = \frac{\sum_{i=1}^{n} \frac{O_i}{G_i} \cdot W_i}{\sum_{i=1}^{n} W_i} \quad \text{.....(Formula 5)}$$

Second, Actual Cost Efficiency ($CE_{(a)}$) measures are made by dividing actual total cost of the program ($C_{(a)}$) by unit of outputs, such as total number of completions (O_1), students enrolled in the program (O_2), or student contact hours (O_3). Each of the products is called actual unit cost ($UC_{(a)}$). It is:

$$CE_{(a)} = \frac{C_{(a)}}{O_1}, \frac{C_{(a)}}{O_2}, \frac{C_{(a)}}{O_3}, \text{ or } UC_{(a)} \quad \text{...(Formula 6)}$$

In the same way, Budgeted Cost Efficiency ($CE_{(b)}$) measures are made by:

$$CE_{(b)} = \frac{C_{(b)}}{O_1}, \frac{C_{(b)}}{O_2}, \frac{C_{(b)}}{O_3}, \text{ or } UC_{(b)} \quad \text{...(Formula 7)}$$

By comparing formula six with seven, a Cost Efficiency Index (CEI) is made as follows:

$$CEI = \frac{C_{(a)}/O_1}{C_{(b)}/O_1}, \frac{C_{(a)}/O_2}{C_{(b)}/O_2}, \frac{C_{(a)}/O_3}{C_{(b)}/O_3}, \text{ or } \frac{UC_{(a)}}{UC_{(b)}}$$

$$= \frac{C_{(a)}}{C_{(b)}} \quad \text{.....(Formula 8)}$$

Finally, based upon the measures of program effectiveness and cost efficiency, a cost-effectiveness ratio and a performance ratio can be computed. A Cost-Effectiveness Ratio (C/ER) is derived by:

$$C/ER = \frac{(1), (2), (3), (4), \text{ or } (5)}{(6)} \quad \text{.....(Formula 9)}$$

The ratio indicates the degree of goal attainments per unit cost. A Performance Ratio (PR) is generated from the division of program effectiveness by cost efficiency index as follows:

$$PR = \frac{(1), (2), (3), (4), \text{ or } (5)}{(8)} \quad \text{.....(Formula 10)}$$

This performance ratio indicates more or less than one unit, and represents the relationship between the program effectiveness and cost efficiency as measured by formulas one through nine.

COST-EFFECTIVENESS MODEL: PROCEDURES

A standard procedure was developed for using the cost-effectiveness analysis model based upon three selected studies. The procedure consists of seven steps within three phases: (1) planning a cost-effectiveness analysis, (2) implementing the analysis, and (3) utilizing the results from the analysis (See Figure 4).

Burgett (1970) developed a procedural model consisting of six steps:

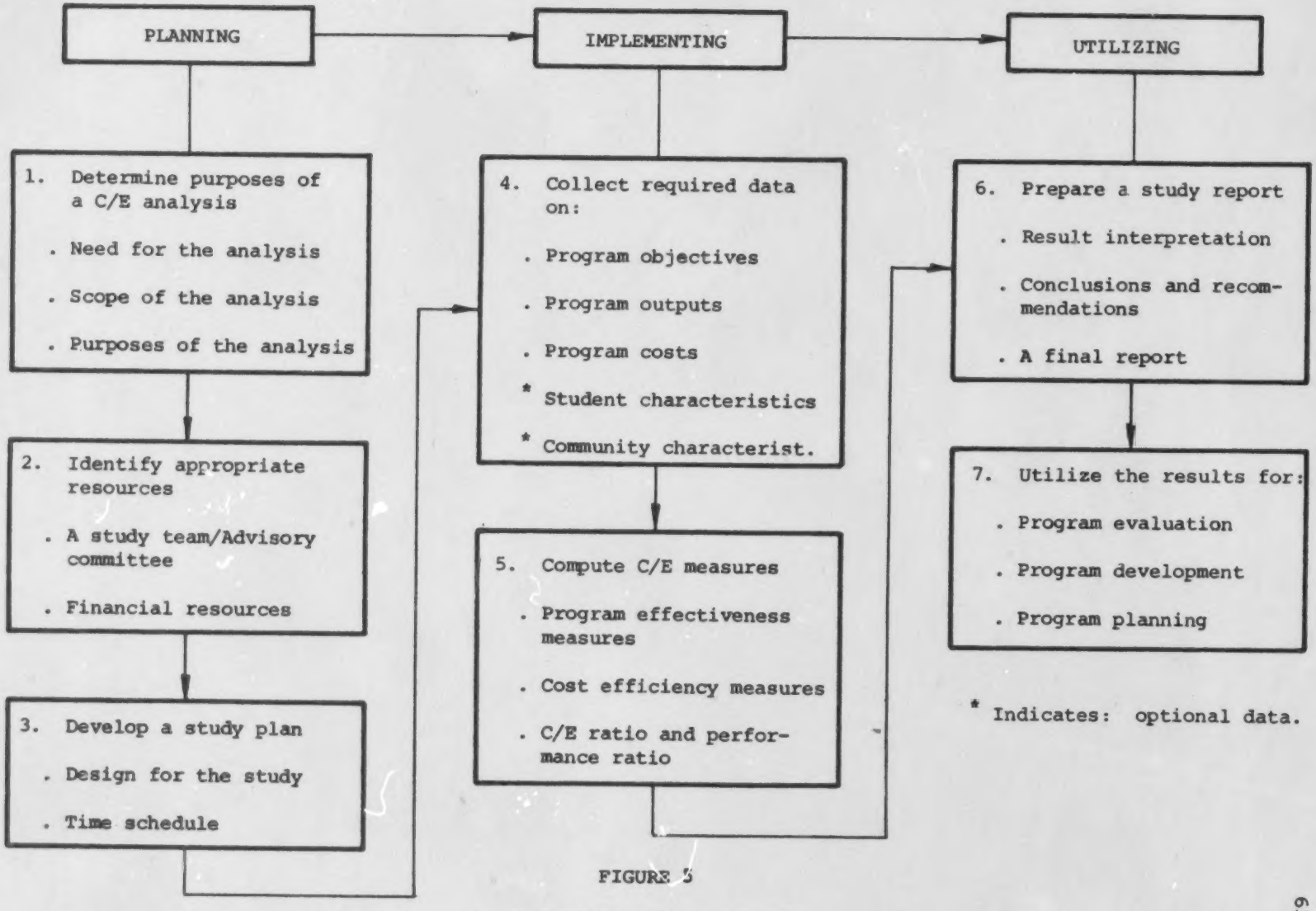

FIGURE 5

PROCEDURE FOR USING THE
COST-EFFECTIVENESS ANALYSIS MODEL

(1) determination of program objectives, (2) identification of pertinent behavior, (3) development of effectiveness and cost measures, (4) data collection, (5) analysis, and (6) appraisal (p. 36). Pearson (1972) classified the process of cost-effectiveness analysis into two categories: (1) a model building in a stepwise procedure and (2) application of a particular model to a real-world practical situation in an input, analysis, and output scheme (p. 35). Forbes (1974) divided cost-effectiveness data analysis into three phases: (1) planning before the collection of data, (2) monitoring during the collection of data, and (3) analyzing after data collection. The literature was synthesized to develop a standard procedure for using the cost-effectiveness analysis model.

Administrative awareness and commitment to use of the cost-effectiveness analysis model will encourage the staff to develop a plan for a cost-effectiveness analysis. After implementing the analysis, the administrator will utilize the results in the decision making process pertaining to program evaluation, development, and planning. A deliberate effort for specifying each step within each phase follows.

Planning a Cost-Effectiveness Analysis

The planning phase includes the determination of the purposes of a cost-effectiveness analysis, identification of appropriate resources for attaining the purposes, and development of a study plan.

Determination of Purposes of the Analysis. The first step is to determine analytical purposes for using the model. The need to conduct a cost-effectiveness analysis will be discussed in determining the purposes of the analysis. To obtain available information specific to some decision situations, anticipated information from the analysis and the

scope of the analysis should be defined. Based on the need and scope of the analysis, analytical purposes will be specified for improving program operation, providing information needed in decision-making and/or improving public understanding and support for vocational programs. The identified needs, scope, and purposes will be summarized into a request for a cost-effectiveness study.

Identification of Appropriate Resources. The next step in the planning phase is to identify personnel and fiscal resources required for implementing the analysis. A cost-effectiveness analysis requires a study team consisting of appropriate personnel to conduct the analysis and adequate staff for the assignment of responsibilities to gather data. To aid in achieving staff participation, the following approaches are suggested: (1) in-service training sessions which use practical problems as examples of how cost-effectiveness analysis can be used; (2) involvement of key staff members in a decision-making process which necessitates the use of cost-effectiveness analysis; (3) and demonstration by administrators that cost-effectiveness can be used to reach better decisions in the planning and operation of the school (Forbes, 1974, p. 26). If it is necessary in planning the analysis, an advisory committee including representatives of the board, teachers, parents, and business should be organized. The study team should invite consultants from professional agencies to provide technical assistance.

Financial resources should be identified to support the analysis on the time and performance basis. The chief administrator's commitment to the use of cost-effectiveness analysis in a decision-making process will be reflected in the establishment of a budget to help the implementation

of the analysis.

Development of a Study Plan. After a study team is organized, an analytical study plan will be developed. The plan will include a design of the study and a time schedule as a flow of procedural activities over time. A design for the analytical study will be developed on the basis of the request for study. When the analysis is addressed to certain decision situations, the needs and anticipated information will be specified in defining the objectives of the study. To reach the objectives, data types and required data, and analytical forms should be identified in the design.

A time schedule for the study will be developed to include the procedural activities from start to completion of the study. Appropriate time should be allocated to data collection, analysis, interpretation, and writing a final report.

Implementing a Cost-Effectiveness Analysis

As scheduled in the plan, a cost-effectiveness analysis will be implemented. The implementing phase consists of two steps: (1) collection of data required for cost-effectiveness analysis, and (2) computation of the resulting measures.

Collection of the Required Data. Data required for each of the components essential in cost-effectiveness analysis will be collected and analyzed, and the resulting measures will be computed. First, student school records and follow-up data on identified programs for analysis will be reviewed to identify program objectives. Program objectives will be specified in measurable terms as target goals. Considering the program

relativeness, policy preferences, and data availability, a number of objectives and specified target goals will be selected from among the seven objective categories developed in the model. Already assigned target goals will be identified; otherwise, appropriate target goals will be set forth by the authority. Second, program output data will be collected in accordance with program objectives. The predetermined program target goals and the actual outputs will be used for computing various program effectiveness measures. Third, specific cost elements of a vocational program will be identified and appropriate costs be assigned to each of the cost elements. When the focus of the cost-effectiveness activity is directed to the specific program, the direct costs will be allocated to directly related elements and indirect costs will be prorated to the program. Then, additional data on student characteristics within the program and selected related community characteristics data will be collected for use in interpreting results of the analysis.

Instruments developed in the model will be used for collecting the required data on program effectiveness and cost analysis. Another task along with data collection is a monitoring activity which will be performed to ensure that the most reliable data possible are collected. Any problems found during the data collection should be explicitly recorded for further consideration.

Computation of Measures. Following the data collection step, analytical techniques will be executed to identify program effectiveness measures, cost efficiency measures, and a cost-effectiveness ratio and/or performance ratio. As previously discussed, program effectiveness scores will be computed as measures of program goal attainments. Scores will be

combined into an effectiveness index. Cost efficiency will be measured by computing unit cost per student, per student contact hour, or per completion or graduate. Furthermore, a cost efficiency index will be formulated by the ratio of actual unit cost over budgeted unit cost of the program under study. Finally, a cost-effectiveness ratio will be computed by dividing the program effectiveness index by the unit cost. In addition, a performance ratio will be drawn from the division of the program effectiveness index by the cost efficiency index.

Utilizing the Results from the Analysis

After the analysis is finished, a study report will be made to decision-makers so that they may utilize the results in decision-making.

Preparation of a Study Report. The resulting cost-effectiveness measures should be interpreted with consideration of additional information concerning student and community characteristics. Through discussion of the results and interpretation among the concerned people, conclusions and recommendations will be drawn. Then, a final report will be made to decision-makers.

Utilization of the Results. Based upon the reported conclusions and recommendations, analytical results will be utilized for program evaluation, development, and planning. For a program evaluation, cost information will be related to program effectiveness. It will be possible to determine what cost increases will mean to the degree of program effectiveness at different time periods. Conversely, the program effectiveness will be related to each of the cost items associated with the program in order to identify cost items leading to cost increases for

the program. Cost efficiency and program effectiveness will be compared on the basis of a cost-effectiveness ratio or a performance ratio.

The analytical results and conclusions will be used in developing new programs. Cost-effectiveness measures will provide decision-makers with information on the need for new program development. If a program is identified as being very ineffective and inefficient, a judgement should be made that the program should be modified or deleted. Based upon the information, final decisions will be made to develop strategies either modifying the program or developing a new alternative program.

For program planning, the analytical results and recommendations will provide a basis for future planning for the improvement of vocational programs. A short-range (one or two-year) plan will be made for increasing program effectiveness and/or cost efficiency. To improve overall vocational programs, a long-range (five-year) plan will be developed from long-time perspectives.

SUMMARY

A conceptual model was developed for use in analyzing cost-effectiveness of secondary vocational instructional programs. The proposed model was focused upon relating four major components: (1) vocational programs, (2) objectives/target goals, (3) costs, and (4) outputs; and generating three measures: (1) program effectiveness, (2) cost efficiency, and (3) a cost-effectiveness and performance ratio. The primary effort was to define the conceptual and technical procedures involved in the model.

Based upon the specified data types needed for a cost-effectiveness

analysis, a set of five data collection instruments was developed: (1) School Corporation (District) Information; (2) Secondary Vocational Instructional Program Data; (3) Students' Follow-up Data; (4) Employers' Opinion on Vocational Training of Employees, and (5) Vocational Instructional Program Cost Data. Analytical forms and techniques were developed along with the formulas for computing cost-effectiveness measures.

Finally, a standard procedure for using the cost-effectiveness analysis model and instruments was conceptualized into seven steps within three phases: (1) planning a cost-effectiveness analysis; (2) implementing the analysis, and (3) utilizing the results from the analysis. The procedural scheme will be applied to guide locally directed cost-effectiveness studies, which will be conducted by vocational administrators.

CHAPTER IV

Evaluation of the Products and Conclusions

The cost-effectiveness analysis model and instruments were reviewed and examined by both research and evaluation experts and field personnel to increase their usefulness. Throughout the procedure, conclusions were drawn along with recommendations and suggestions for further studies.

EVALUATION OF THE PRODUCTS

To increase the usefulness of the cost-effectiveness analysis model and related data collection instruments, primary attention was focused upon (1) a review of the model, (2) a revision of instruments, and (3) an examination of the cost-effectiveness measures.

Review of the Cost-Effectiveness Analysis Model

The cost-effectiveness analysis model, including major components, was reviewed by the project's Advisory Committee and National Advisory Panel. The Advisory Committee, constituted of Indiana educational personnel, consisted of three local vocational directors, three state level vocational officers and a university professor of vocational education. Four university professors of research and evaluation and two research and management specialists in vocational education studies constituted the National Advisory Panel for the cost-effectiveness project.

The Advisory Committee was concerned with (1) applicability of the

model to local program studies, (2) specification of the program objectives, (3) appropriateness of the cost analysis system, and (4) validity of the data collection instruments. The National Advisory Panel was directed to the same major tasks of the Advisory Committee. The National Panel devoted attention to the validity and appropriateness of the proposed model for cost-effectiveness studies of vocational programs.

The seven objective categories and target goals were reviewed and approved by the Advisory Committee (Appendix B). The National Advisory Panel endorsed the objective and target goal concepts and specifications.

The National Advisory Panel members were primarily concerned with the measurement of a cost-effectiveness ratio. In the initial draft, a cost-effectiveness ratio was defined as the relationship between a program effectiveness index and a cost efficiency index. Some objection was raised to the proposed definition of the cost-effectiveness ratio, and the following formula was suggested by some panel members to compute a performance index:

$$\frac{\text{Actual Output/Actual Cost}}{\text{Planned Output/Planned Cost}} = \text{Performance Index} \quad \text{...(Formula a)}$$

However, the formula could be reformed as

$$\frac{\text{Actual Output/Planned Output}}{\text{Actual Cost/Planned Cost}} \quad \text{.....(Formula b)}$$

If the planned output were referred to as program objectives, and planned cost were the same as budgeted cost, so defined in the model, then the modification would result in no difference in mathematical procedure between the suggested formula and the model. However, the product from

formula a was considered as "performance index;" whereas formula b was developed into:

$$\frac{\text{Effectiveness Index}}{\text{Efficiency Index}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Formula c)}$$

whose product was called "cost-effectiveness ratio" in the model.

Since some confusion may have resulted in using the terms performance index and cost-effectiveness ratio, the cost-effectiveness ratio was redefined by the division of the effectiveness index over actual unit cost, and the product from formula c was called a "performance ratio." The National Advisory Panel accepted the proposed changes. The Advisory Committee endorsed the model's appropriateness to vocational program management in Indiana.

Revision of Data Collection Instruments

Drafts of data collection instruments were presented to the Advisory Committee and National Panel members. Additionally, local vocational directors and business managers within the same school corporation examined the set of data collection instruments in terms of data availability, ease of collecting data, and item arrangement. Based upon the suggestions and comments provided by advisory members and field personnel, raw-data collection forms were revised into simplified forms to collect data from school corporations.

Two instruments for collecting student input data and community characteristics data were eliminated from the set of instruments. These instruments would have duplicated measures already in use and would have

forced standardization of measures that should remain highly specific to the community. Previously developed high school student questionnaires and community data forms in use with school corporations were suggested for collecting both student and community characteristics data.

The Advisory Committee meeting, after reviewing the revised instruments accepted them with minor changes. The National Advisory Panel's recommendation to simplify the instrumentation was incorporated. The finalized data collection instruments are attached as Appendix C.

Examination of Cost-Effectiveness Measures

When evaluating vocational programs using the cost-effectiveness analysis model, measures are expected to provide answers to three primary questions: (1) Is the program effective, or to what extent have the program objectives been achieved? (2) How efficient is the program? and (3) Does the program perform in an effective and efficient manner? To investigate these questions, cost-effectiveness measures developed in the model were examined using hypothetical data.

Suppose three vocational instructional programs (A, B, and C) were selected from among the vocational programs within an area vocational school for analysis. At the beginning of the school year, program objectives would be specified by three target goals of each program: (1) number of expected completions, (2) percentage of passing licensure examinations, and (3) percentage of expected employment. After program operation, program outputs were identified by actual attainments and associated with each of the target goals. Also, program costs were analyzed to identify both actual and budgeted costs for each instructional program. The hypothetical data were as shown in Table IV.

TABLE IV

HYPOTHETICAL DATA FOR A COST-EFFECTIVENESS ANALYSIS

Data Classification	Instructional Programs A	B	C
1. Objectives: Targeted Goals			
a. # Expected completion	50	40	45
b. % Passing tests	90%	80%	75%
c. % Expected employment	80%	70%	60%
2. Outputs: Actual Attainments			
a. # Actual completions	45	35	40
b. % Passed	85%	75%	60%
c. % Actual employed	70%	60%	50%
3. Costs: Budgeted/and Expended			
a. $ Total annual expenditure	$ 55,000	$ 35,000	$ 38,000
b. $ Total annual budget	$ 50,000	$ 35,000	$ 40,000

Based on these hypothetical data, cost-effectiveness measures were computed, using the formulas one through ten developed in Chapter III (pp. 59-61). The computing procedures were as follows (See Table V).

1. Program effectiveness scores were computed by dividing outputs by target goals using Formula one. Then each score was weighted according to its importance: 15 points for employment, 10 points for test-pass, and 5 points for completion.

2. Composite and average program effectiveness indices were made by adding the effectiveness scores following Formula two and three. Based on the weighted effectiveness scores, weighted composite and weighted average effectiveness indices were made using formulas four and five.

3. Cost efficiency was measured by unit costs. Actual and budgeted unit costs per completion were computed by Formula six and seven.

TABLE V

COMPUTATION OF COST-EFFECTIVENESS MEASURES,
USING HYPOTHETICAL DATA

C/E Measures	Instructional Programs A	B	C
1. Program Effectiveness Scores			
a. % Completion	90.0%	87.5%	68.9%
b. % Test-pass	94.4%	93.8%	80.0%
c. % Employment	87.5%	85.7%	83.3%
(Weighted Effectiveness Scores)			
d. % Completion X 5	450.0	267.0	252.2
e. % Test-pass X 10	944.0	938.0	800.0
f. % Employment X 15	1312.5	1285.5	1249.5
2. Program Effectiveness Index			
a. Composite index: (1a + 1b + 1c)	271.9	267.0	252.2
b. Average index: (2a)/3	90.6	89.0	84.1
c. Weighted composite index: (1d + 1e + 1f)	2706.5	2661.0	2493.9
d. Weighted average index: (2c)/30	90.2	88.0	83.1
3. Cost Efficiency: Unit costs			
a. Actual unit cost per completion	$ 1,222	$ 1,000	$ 950
b. Budgeted unit cost per completion	$ 1,111	$ 1,000	$ 1,000
4. Cost Efficiency Index			
a. Actual unit cost/budget unit cost, or	1.1	1	.95
b. Actual total cost/total budgeted cost	1.1	1	.95
5. C/E ratio and performance ratio			
a. C/E ratio: (2d)/(3a)	.074	.088	.087
b. Performance ratio: (2d)/(4a)	82.0	88.0	87.4

4. A cost efficiency index was made by dividing actual unit or total cost by budgeted unit or total cost, using Formula eight.

5. Finally, according to Formula nine a cost-effectiveness ratio was computed by dividing the weighted average effectiveness index (2-d) by the actual unit cost (3-a). Then a performance ratio was derived from the division of the weighted average effectiveness index (2-d) over cost efficiency index (4), using Formula ten.

Cost-effectiveness measures for each instructional program resulted and appear in Table V. The program effectiveness index, cost efficiency index, and cost-effectiveness ratio or performance ratio provide a basis for answering three questions, respectively: (1) Which program was relatively most effective?, (2) Which program was relatively most efficient?, and (3) Which program performed in the most effective and efficient manner?

Referring to the program effectiveness index, Program A was indicated as the most effective among the three programs; whereas Program C was considered the most efficient on the basis of the cost efficiency index. Furthermore, according to the performance ratio, Program B was judged the most effective and efficient among the three programs. Thus, these cost-effectiveness measures can be utilized as criteria in evaluating or comparing the degree of effectiveness, efficiency, and performance of vocational instructional programs.

CONCLUSIONS AND RECOMMENDATIONS

This report attempted to conceptualize the nature of cost-effectiveness analysis and to develop a cost-effectiveness analysis model for secondary vocational programs that included data collection instruments,

analytical forms, and standard procedures for using the cost-effectiveness analysis system. Throughout the advisory committee meetings and field site visitations, the products from the project were evaluated to increase their utilization by secondary vocational administrators and educators.

Conclusions

With regard to the products from the project, the following conclusions are drawn:

1. The cost-effectiveness analysis concept encompasses a variety of features, but it can be defined as an analytical tool for assessing outcomes of operating and/or alternative programs in achieving specified objectives in relation to costs. This definition distinguishes the cost-effectiveness concept from the cost-benefit concept, and provides a conceptual model for generating quantified cost-effectiveness measures.

2. The development of the cost-effectiveness analysis model for secondary vocational programs identified four major components. The proper manipulation of the components results in three important measures providing answers to significant management questions.

3. As a comprehensive framework, the proposed model is expected to be used as a further step in cost-effectiveness studies. The relating of program objectives and specifications and the cost analysis scheme generating the three measures extends the cost-effectiveness concept to practical management information for decision makers.

4. Using the data types and instruments developed in the study, empirical data analyses can be made to determine quantified cost-effectiveness measures as criteria for evaluating vocational programs.

5. As a standard procedure for using the cost-effectiveness analysis model, seven steps were conceptualized within three phases -- planning, implementing, and utilization. The procedural scheme can be applied to guide locally directed cost-effectiveness studies, which will be conducted by vocational administrators. Step-by-step activities were developed in Administrator's Manual.

Recommendations

Although this report was concerned with the cost-effectiveness analysis of secondary vocational programs, its use may be extended. And also the products from the project will be improved by cumulated research efforts. From this point of view, the following recommendations including suggestions for further studies are made:

1. Even though the cost-effectiveness model has focused upon secondary vocational programs, the concepts may be applied to post-secondary vocational program evaluation and planning. Furthermore, the basic conceptual scheme and technical procedures developed in the model can be extended to the evaluation of any kinds of on-going and/or alternative programs with appropriate program objective specifications.

2. In determining program objectives and target goals, student and community characteristics information should be fully considered. The three cost-effectiveness measures derived from the model should not be used as exclusive criteria in the decision-making process without considerations of student and community characteristics. Concerned people should be involved in determining appropriate program target goals as well as interpreting the results.

3. Cost-effectiveness analyses should be continued as a recycling process. Repeated analyses based on accumulated data will increase the utility of the analysis.

4. To facilitate the implementation of cost-effectiveness analysis model and data forms as a program management system, further efforts should be given to both pilot studies for demonstration and to statewide dissemination conferences in which local vocational administrators and other concerned people may participate. The Project Advisory Committee strongly recommended that pilot implementation studies be conducted at selected school corporations, and that statewide dissemination conferences be held, with the support of state and local education agencies.

5. Additional research will be needed for determining vocational program objectives and standardizing cost analysis. Based upon further research efforts, the model and products will be improved for general use.

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Appendix

APPENDIX A

APPENDIX A

A Program Classification of Vocational Program Areas, Sub-program Areas and/or Courses

OE Code	Program	Available (V) at the Secondary Level
01.0000	Agriculture	
01.0100	Agricultural Production	
01.0200	Agricultural Supplies/Services	
01.0300	Agricultural Mechanics	
01.0400	Agricultural Products	
01.0500	Ornamental Horticulture	
01.0600	Agricultural Resources	
01.0700	Forestry	
01.9900	Other	
04.0000	Distribution	
04.0100	Advertising Services	
04.0200	Apparel and Accessories	
04.0300	Automotive	
04.0400	Finance and Credit	
04.0500	Floristry	
04.0600	Food Distribution	
04.0700	Food Services	
04.0800	General Merchandise	
04.0900	Hardware, Building Materials	
04.1000	Home Furnishings	
04.1100	Hotel and Lodging	
04.1200	Industrial Marketing	
04.1300	Insurance	
04.1400	International Trade	
04.1500	Personal Services	
04.1600	Petroleum	
04.1700	Real Estate	
04.1800	Recreation and Tourism	
04.1900	Transportation	
04.9900	Other	
07.0000	Health	
07.0101	Dental Assistant	
07.0102	Dental Hygienist (associate degree)	
07.0103	Dental Laboratory Technology	
07.0203	Medical Laboratory Assisting	
07.0299	Other Medical Laboratory Technology	
07.0301	Nursing (associate degree)	
07.0302	Practical (vocational) Nursing	
07.0303	Nursing Assistant (aide)	
07.0401	Occupational Therapy	
07.0402	Physical Therapy	

APPENDIX A (continued)

OE Code	Program	Available (√) at the Secondary Level
07.0501	Radiologic Technology	
07.0700	Environmental Health	
07.0800	Mental Health Technology	
07.0903	Inhalation Therapy	
07.0904	Medical Assistant	
07.0906	Health Aide	
07.9900	Other	
09.0200	Occupational Preparation, Home Economics	
09.0201	Care and Guidance of Children	
09.0202	Clothing MGMT., Production and Services	
09.0203	Food Management, Production and Services	
09.0204	Home Furnishing, Equipment and Services	
09.0205	Institutional & Home Management & Services	
09.0299	Other	
14.0000	Office	
14.0100	Accounting and Computing Occupations	
14.0200	Business Data Processing Systems Occupations	
14.0300	Filing, Office Machines, Clerical Occupations	
14.0400	Information Communication Occupations	
14.0500	Materials Support, Transportation, Etc.	
14.0600	Personnel Training and Related Occupations	
14.0700	Steno, Secretarial and Related Occupations	
14.0800	Supervisory and Admin. Management Occupations	
14.0900	Typing and Related Occupations	
14.9900	Other	
16.0000	Technical	
16.0101	Aeronautical Technology	
16.0103	Architectural Technology	
16.0104	Automotive Technology	
16.0106	Civil Technology	
16.0107	Electrical Technology	
16.0108	Electronic Technology	
16.0110	Environmental Control Technology	
16.0111	Industrial Technology	
16.0113	Mechanical Technology	
16.0601	Commercial Pilot Training	
16.9901	Air Pollution Technology	
16.9902	W and Waste Water Technology	
16.9900	Other	

APPENDIX A (continued)

OE Code	Program	Available (✓) at the Secondary Level
17.0000	Trades and Industry	
17.0100	Air Conditioning	
17.0200	Appliance Repair	
17.0301	Body and Fender Repair	
17.0302	Auto Mechanics	
17.0399	Other Automotive	
17.0400	Aviation Occupations	
17.0500	Blueprint Reading	
17.0600	Business Machine Maintenance	
17.0700	Commercial Art Occupations	
17.1001	Carpentry	
17.1002	Electricity	
17.1004	Masonry	
17.1007	Plumbing and Pipefitting	
17.1099	Other Construction and Maintenance	
17.0900	Commercial Photography Occupations	
17.1100	Custodial Service	
17.1200	Diesel Mechanic	
17.1300	Drafting Occupations	
17.1400	Electrical Occupations	
17.1500	Electronic Occupations	
17.1600	Fabric Maintenance Services	
17.1700	Foremanship, Supervision and Mgt. Development	
17.1900	Graphic Arts Occupations	
17.2200	Maritime Occupations	
17.2300	Metalworking Occupations	
17.2400	Metallurgy Occupations	
17.2601	Barbering	
17.2602	Cosmetology	
17.2700	Plastics Occupations	
17.2801	Fireman Training	
17.2802	Law Enforcement Training	
17.2900	Quantity Food Occupations	
17.3000	Refrigeration	
17.3100	Small Engine Repair	
17.3300	Textile Production and Fabrication	
17.3400	Leather Working	
17.3500	Upholstering	
17.3600	Woodworking Occupations	
17.9900	Other	

APPENDIX B

APPENDIX B

PROGRAM OBJECTIVES AND TARGET GOALS

OBJECTIVE 1. *Aid students enrolled in vocational education to successfully complete a secondary occupational program.*

1-a. _____ percent of the student population will be enrolled in the secondary vocational program during the 19__ - 19__ school year.

1-b. _____ percent of the students will complete the program requirements.

1-c. _____ percent of the student completions will have on the job occupational experience.

1-d. _____ percent less dropout rate will occur in the vocational program than the total dropout rate for the entire school.

1-e. _____ percent of the student completions will rate their program as satisfactorily meeting their educational goals.

1-f. _____ percent of the student completions will indicate they would recommend their vocational program to other students.

OBJECTIVE 2. *Assist special student groups to successfully achieve in a secondary vocational program.*

2-a. _____ percent of the persons identified as special education students will be enrolled in the vocational program (mainstream).

2-b. _____ percent of the disadvantaged students will be enrolled in the vocational program.

2-c. _____ disadvantaged persons (economically and/or educationally) will complete the secondary vocational program.

2-d. _____ disadvantaged students (economically and/or educationally) will participate in work-study programs.

2-e. _____ handicapped persons (physical and/or mental) will successfully complete the secondary vocational program.

2-f. _____ exceptional youth will complete the secondary vocational program.

2-g. _____ percent of the students enrolled will represent the sex minority in those programs traditionally considered sex-stereotyped.

2-h. _____ percent of the students classified in special student groups who can benefit from a related or enabling skills course will be enrolled in such courses.

2-i. _____ percent of the students enrolled in related or enabling skills courses will attain minimum competencies in order to benefit from vocational or preparatory programs.

2-j. _____ percent of the students classified in special student groups will rate their vocational program as satisfactorily meeting their educational goals.

2-k. _____ percent of the special student group completions will indicate they would recommend their vocational program to other students.

OBJECTIVE 3. *Provide vocational education for secondary school youth in accordance with their occupational preparation.*

3-a. _____ percent of the students available for and having sought employment will be employed full-time in less than fifteen weeks after graduation. (Consider military and apprenticeships as employed.)

3-b. _____ percent of the graduates available for and having sought employment in their specialization will be employed in their specialization in less than fifteen weeks after graduation. (Include military and apprenticeships if in the area of specialization.)

3-c. _____ percent of the graduates available for employment will be employed in their specialization or in a position they considered related to their area in less than fifteen weeks after graduation. (Include military and apprenticeships if in specialization or related area.)

3-d. _____ percent of the enrollees who terminate schooling before completing program requirements will find their first full-time job in the occupation for which they were being trained or a related area. (Include military and apprenticeships if in specialization or related area.)

3-e. _____ percent of the graduates of any licensed occupation program (who apply and take) will pass the appropriate examination.

3-f. _____ percent of the students responding on a follow-up study will indicate they are satisfied with their job.

3-g. _____ percent of the students employed six (6) months after graduation will indicate that their skill preparation was adequate for their present job.

APPENDIX B (continued)

3-h. _____ percent of the graduates will indicate they were adequately prepared to work with supervisors, co-workers and subordinates.

OBJECTIVE 4. *Provide leadership development activities for students enrolled in vocational programs through a youth organization functioning as an integral part of the vocational instruction.*

4-a. _____ percent of the students enrolled in the vocational program will have taken an active part in (youth organization, i.e., VICA, FFA, FHA, etc.) activities for the school year.

4-b. _____ percent of youth organization participants will rate the activities as meeting their needs and interests.

OBJECTIVE 5. *Provide guidance and counseling services (career development) information appropriate to continued education or employment for students enrolled in vocational programs.*

5-a. _____ vocational students will receive career counseling and guidance services.

5-b. _____ students will receive career development information during the school year 19 __ - 19 __.

5-c. _____ percent of the students will indicate career guidance and counseling services as adequate after completion of their vocational program.

5-d. _____ percent of the students receiving exploratory career information will rate the experience as having influence on their career choice.

OBJECTIVE 6. *Provide vocational programs to fulfill the requirement of the labor markets and the employment community manpower needs.*

6-a. _____ percent of the student completions will be working in the employment community serviced by the school corporation.

6-b. _____ percent of the student completions will seek employment external to the employment community in which they were trained.

6-c. _____ percent of all students will be enrolled in the vocational program that is considered to have high employment community and manpower occupational needs. (Projected)

6-d. _____ employers will value the vocational program as a source of trained manpower.

6-e. _____ employers will indicate that the employees' vocational preparation was critical in the employment decision.

6-f. _____ employers will rank the employees' skill and knowledge level at a minimum of fairly skilled or above.

6-g. _____ employers will indicate job advancement is related to training received in the vocational education programs.

6-h. _____ employers will rate the employees on the job maturity factors at a minimum mean of good or above.

OBJECTIVE 7. *Encourage vocational graduates to continue their education after completion of their secondary program.*

7-a. _____ percent of the students who complete the vocational program will be enrolled in advanced study programs.

7-b. _____ percent of the students enrolled in advanced study programs will be in the same program specialty as their secondary vocational program.

7-c. _____ percent of the students enrolled in advanced study programs will be in their specialization or programs which they considered related to their secondary vocational program.

7-d. _____ percent of the students enrolled in advanced study programs will rate their secondary vocational program as instrumental in their decision to continue their education.

7-e. _____ percent of the students enrolled in advanced study programs will indicate their vocational program prepared them for their pursuit of advanced study.

APPENDIX C

School Corporation Information*

C/E FORM I-1. FACULTY FTE, STUDENT AVERAGE DAILY MEMBERSHIP AND CONTACT HOURS

(1) School	(2) Total FTE	Average Daily Membership (3) Female	(4) Male	(5) Total		(6) Total School Hours Per Year		(7) Total Student Contact Hours
1. Corporation					X	1080	=	
2. Special Students								
2a. Disadvantaged								
2b. Gifted								
2c. Handicapped								

C/E FORM I-2. BUILDING SPACE, USE, AND TIME/FLOOR DATA**

(1) Building(s)	(2) Total Sq. Ft. Space For Instructional Building(s)		(3) Number Hours In Use***		(4) Time/Floor Unit		(5) Percent of Time/Floor
1. Vocational		X		=		÷	
2. Corporation		X		=			=

*Corporation is defined as the level at which budget and expenditures are expressed. (K-12, High School, or Area Center)

**If all budgets and expenditures at area center level or vocational level, only Line 1 needs to be filled out.

***Entry for Line 1, Column 3 can be obtained for Column 5, Form V-8. Entry for Line 2, Column 3 is the product of average hours per school day for corporation X number of school days X the number of classrooms in corporation.

Secondary Vocational Instructional Program Data

C/E FORM II-1. PROGRAM AVERAGE DAILY MEMBERSHIP AND CONTACT HOURS

(1) Instructional Programs	Average Daily Membership			X	School Hours Per Year			=	(8) Total Student Contact Hours
	(2) Female	(3) Male	(4) Total		(5) Number Days	(6) Hours Per Day	(7) Total Hours/Yr.		
1.									
2.									
3.									
4.									
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7.									
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9.									
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16.									
17.									
18.									
19.									
20.									
TOTAL									

Secondary Vocational Instructional Program Data

C/E FORM II-2. STUDENT ENROLLMENT, DROPOUT AND COMPLETION DATA

(1) Instructional Programs	(2) ADM Enrollment		(3) Enrollment Gain		(4) Total Enrollment	(5) Enrollment Losses Other Than Dropout	(6) Dropouts	Completions		
	Male	Female	Male	Female				(7) Prepared For Further Training	(8) Employable	(9) Total
1.										
2.										
3.										
4.										
5.										
6.										
7.										
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10.										
11.										
12.										
13.										
14.										
15.										
16.										
17.										
18.										
19.										
20.										
TOTAL										

Secondary Vocational Instructional Program Data

C/E FORM II-3. SPECIAL STUDENT ENROLLMENT, COMPLETION, DROPOUT, AND WORKSTUDY DATA

(1) Instructional Programs	(2) ADM Enrollment			(3) Enrollment Gain			(4) Total Enrollment	(5) Enrollment Losses Other Than Dropout	(6) Dropouts	Completions									(10) Total Work Study
										(7) Prepared			(8) Employable			(9) Total			
	Dad	Gftd	Hdc	Dad	Gftd	Hdc				Dad	Gftd	Hdc	Dad	Gftd	Hdc	Dad	Gftd	Hdc	
1.																			
2.																			
3.																			
4.																			
5.																			
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12.																			
13.																			
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15.																			
16.																			
17.																			
18.																			
19.																			
20.																			
TOTAL																			

Secondary Vocational Instructional Program Data

C/E FORM II-4. COUNSELOR PROGRAM ENROLLMENT ANALYSIS* Program: _____

(1) Student Names	(2) Special Students			(3) Enrolled in Special Courses	(4) Does Not Need Special Courses	(5) Not Enrolled in Special Courses	(6) Received Services		
	Dad	Gftd	Hdc				C & G	Career Dev.	Other
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
TOTAL									

*Check the status of the above students: special student; i.e., disadvantaged, gifted, handicapped; enrolled in such courses as reading improvement, etc. Place a check (✓) in all columns that apply.

(For Purposes Of "Privacy Act" Return This Portion To C/E Study Leader)

Enter totals for each column C/E FORM II-4

(1) Instructional Program	(2) Special Students			(3) Enrolled in Special Courses	(4) Does Not Need Special Courses	(5) Not Enrolled in Special Courses	(6) Received Services		
	Dad	Gftd	Hdc				C & G	Career	Other

Secondary Vocational Instructional Program Data

C/E FORM II-5. SPECIAL STUDENTS ENROLLED IN VOCATIONAL PROGRAMS AND RELATED COURSES

(1) Instructional Programs	(2) Special Students			(3) Enrolled In Special Courses	(4) Does Not Need Special Courses	(5) Not Enrolled In Special Courses	(6) Received Services		
	Dsd	Gftd	Hdc				C & G	Career Dev.	Other
1.									
2.									
3.									
4.									
5.									
6.									
7.									
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9.									
10.									
11.									
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14.									
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16.									
17.									
18.									
19.									
20.									
TOTAL									

APPENDIX C (continued)

Secondary Vocational Instructional Program Data

C/E FORM II.8. STUDENT PARTICIPATION IN YOUTH ORGANIZATIONS

(1) Instructional Programs	(2) Youth Organization	(3) Number of Participants
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
TOTAL		

C/E FORM II

Code No. _____

Students' Follow-up Program Rating Scale

This questionnaire is one portion of an evaluation of vocational education programs. Information you can provide will serve as an important basis for decisions regarding local school programs.

The information on this form will be used as a program class profile. Please note that your name does not appear on the questionnaire. This confidential data will not be reported as information on specific students, employers, or teachers. The code number at the top of the page will be used to record person returning the questionnaire.

INSTRUCTIONS: Please mark reponses to the following questions or statements. When you have completed the questionnaire, return it in the enclosed postage paid envelope.

THANK YOU FOR YOUR TIME AND THOUGHTS.

1. Were you enrolled in a vocational education program while in school?

   Yes . . . ☐ No . . . ☐

2. What type of vocational program:

   Agriculture . . . . . ☐
   Distributive Education . . . . . ☐
   Business . . . . . ☐
   Health . . . . . ☐
   Home Economics . . . . . ☐
   Trade & Industry . . . . . ☐

3. Has your address changed since leaving school?

   Yes . . . ☐ No . . . ☐

3a. If you answered "yes" above, where did you move?

   To a place in the same county . . . . . ☐
   To a different county (same state) . . . . . ☐
   To a different state . . . . . ☐

4. Since you left school, did you seek full-time employment? (35 or more hours per week)

   Yes . . . ☐ No . . . ☐

5. What is your present employment status?

   Employed: full-time (35 or more hours per week) . . . . . ☐
   Employed: part-time (less than 35 hours per week) . . . . . ☐
   Not Employed: looking for work . . . . . ☐
   Not Employed: not looking for work . . . . . ☐
   Attending school . . . . . ☐
   Married or getting married . . . . . ☐
   Military . . . . . ☐
   Other (explain) _____

6. Have you had a full-time job since leaving high school?

   Yes . . . ☐ No . . . ☐

Answer these questions if you are working full-time.

7. How long after leaving high school did you begin your first full-time job?

   No waiting period . . . . . ☐
   Less than 4 weeks . . . . . ☐
   4 to 8 weeks . . . . . ☐
   8 to 12 weeks . . . . . ☐
   12 to 15 weeks . . . . . ☐
   15 to 18 weeks . . . . . ☐
   18 to 24 weeks . . . . . ☐

8. Is your present job related to the vocational training you received?

   Same occupation . . . . . ☐
   Highly related . . . . . ☐
   Slightly related . . . . . ☐
   Totally unrelated . . . . . ☐

9. Did your first job require that you take a licensed examination?

   Yes . . . ☐ No . . . ☐

10. Did you pass the examination?

    Yes . . . ☐ No . . . ☐

If you are going to school, answer these questions.

11. Are you enrolled in advanced study?

    Yes . . . ☐ No . . . ☐

12. What is the relationship of your advanced study program to your high school vocational program?

    New program is in the same occupation . . . ☐
    New program is in a related occupation . . ☐
    New program is in an entirely different occupation . . . . . ☐

APPENDIX C (continued)

Rate the following items as they state your personal feelings or experiences. Check the blank according to whether you agree or disagree with the statement.

	Agree (3)	Don't Know (2)	Disagree (1)
13. I'm satisfied with the vocational training I received in high school as meeting my goals.	☐	☐	☐
14. I would recommend this vocational program to others.	☐	☐	☐
15. The vocational youth organization activities met my needs and interests.	☐	☐	☐
16. I feel that the career counseling and guidance services I received at school were adequate.	☐	☐	☐
17. The career information that I received during the school was influential in my career choice.	☐	☐	☐
Rate if working.			
18. I was adequately prepared for my present job by my vocational program.	☐	☐	☐
19. I was adequately trained to get along with others at work by my vocational program.	☐	☐	☐
20. I am satisfied with my present job.	☐	☐	☐
Rate if going to school.			
21. The vocational program that I completed was influential in my decision to take advanced studies.	☐	☐	☐
22. The vocational program that I completed prepared me to pursue advanced study.	☐	☐	☐

Students' Follow-up Program Rating Scale

C/E FORM III-1. TALLY AND SUMMATION SHEET FOR STUDENT FOLLOW-UP

INSTRUCTIONAL PROGRAM _____

(1) Question #3. # of No Boxes Checked	(2) Question #3a. # Moved Out of County or State	(3) Question #4. # of Yes Boxes Checked	(4) Question #5. # Employed Fulltime	(5) Question #5. # Attending School	(6) Question #6. # of Yes Boxes Checked	(7) Question #7. Total Boxes Checked 15 Wks. or Less	(8) Question #7. Total Boxes Checked 15 Wks. or more	(9) Question #8. # Checked Same Occupation	(10) Question #8. # of Boxes Checked Highly or Slightly Related	(11) Question #9. # of Yes Boxes Checked	(12) Question #10. # of Yes Boxes Checked	(13) Question #11. # of Yes Boxes Checked
Tally												
Total												

(14) Question #12. # in Same Occupation	(15) Question #12. # of Boxes Checked Related Occupation	(16) Question #13. # of Agreed Boxes Checked	(17) Question #14. # of Agreed Boxes Checked	(18) Question #15. # of Agreed Boxes Checked	(19) Question #16. # of Agreed Boxes Checked	(20) Question #17. # of Agreed Boxes Checked	(21) Question #18. # of Agreed Boxes Checked	(22) Question #19. # of Agreed Boxes Checked	(23) Question #20. # of Agreed Boxes Checked	(24) Question #21. # of Agreed Boxes Checked	(25) Question #22. # of Agreed Boxes Checked
Tally											
Total											

APPENDIX C (continued)

C/E FORM IV

Code No. _____

Employers' Opinion on Vocational Training of Employees

Dear Employer:

This questionnaire was developed for you to provide information on the vocational training of an employee in your firm. Your response will serve as a basis for decisions regarding local vocational program development and operation. This confidential data will not be reported as information on specific students, employers, or teachers.

Please provide the appropriate information about the designated employee. When you have completed the questionnaire, return it in the enclosed postage paid envelope.

* *

_____ is an employee in your firm.

1. What is the title of the position he/she holds within the firm? (example: secretary, machine operator, cashier, etc.)

   Job title: _____

2. When hiring the person, did you consider his/her vocational training at the high school level as critical in your decision?

   Yes . . . . . ☐ No . . . . . ☐ Undecided . . . . . ☐

3. Please rate the person's occupational skills at the time the person was employed.

   No skill and knowledge . . . . . ☐
   Limited skill and knowledge . . . . . ☐
   Fair skill and knowledge . . . . . ☐
   Exceptional skill and knowledge . . . . . ☐

4. Do you think that the employee's skill or knowledge attained through the vocational training program has allowed the employee to advance in his/her job?

   Yes . . . . . ☐ No . . . . . ☐ Undecided . . . . . ☐

5. Do you look to the vocational education program as a good source of trained personnel?

   Yes . . . . . ☐ No . . . . . ☐ Undecided . . . . . ☐

6. Please rate the employee in the following factors: (check each of the items on the adjacent scale)

Factors	Poor	Fair	Good	Very Good	Excellent
A) Cooperativeness with supervisor					
B) Cooperativeness with other employees					
C) Interest in the job					
D) Attendance and punctuality					
E) Productivity					

Employers' Opinion on Vocational Training of Employees

C/E FORM IV-1. TALLY AND SUMMATION SHEET FOR EMPLOYER FOLLOW-UP

(1) Instructional Programs	(2) Question #2 on Employer Follow-Up # of Yes Boxes Checked Indicating Vocational Preparation Critical		(3) Question #3 on Employer Follow-Up # of Employers Ranking Employed as "Fairly Skilled" or Above		(4) Question #4 on Employer Follow-Up # of Yes Boxes Checked Indicating Advancement Related To Vocational Program		(5) Question #5 on Employer Follow-Up # of Yes Boxes Checked Indicating Employers Value Vocational Programs		(6) Question #6 on Employer Follow-Up # of Employers Rating Employees on 3 out of the 5 Maturity Factors at Good or Above	
	Tally	Total	Tally	Total	Tally	Total	Tally	Total	Tally	Total
1.										
2.										
3.										
4.										
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20.										

APPENDIX C (continued)

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-1.

SALARIES FOR INSTRUCTIONAL PROGRAM STAFF AND FTE DATA*

(1) Instructional Program	(2) Instructional Salary	(3) FTE	(4) Average Instructional Salary
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
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19.			
20.			
TOTAL		÷	=

*Reimburseable salary for all vocational instructional staff.

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-2. FRINGE BENEFITS FOR TEACHING STAFF*

(1) Instructional Programs	(2) Group Health Insurance/Program	(3) Compensation and Relief/Program	(4) Other Benefits/Program	(5) Total
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
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11.				
12.				
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16.				
17.				
18.				
19.				
20.				
TOTAL				

*Retirement and social security benefits paid by state are not included in local costs.

APPENDIX C (continued)

Vocational Instructional Program Cost Data

☐ Budgeted

☐ Actual

C/E FORM V-3. TRAVEL COST ASSIGNED TO PROGRAMS

(1) Instructional Programs	(2) Instructional Personnel	(3) Instructional Activities	(4) Total Cost
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
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18.			
19.			
20.			
TOTAL			

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-4. COST OF INSTRUCTIONAL SUPPLIES AND MATERIALS

(1) Instructional Programs	(2) Consumable Supplies	(3) Text Books and References	(4) Other Supplies	(5) Total Cost
1.				
2.				
3.				
4.				
5.				
6.				
7.				
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20.				
TOTAL				

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-5. COST OF EQUIPMENT USED BY INSTRUCTIONAL PROGRAM

(1) Equipment	Equipment Purchased for Instructional Program								(10) Percent of Time Used	(11) Total Annual Cost for Equipment*
	Previous Purchases				Purchased This Year					
	(2) Original Cost	(3) Life Span	(4) Amt. of Previous Depreciation	(5) Annual Depreciated Cost	(6) Original Cost	(7) Life Span	(8) Non-Depreciated Supplies	(9) Annual Depreciated Cost		
1.										
2.										
3.										
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18.										
19.										
20.										
TOTAL										

*Line entry for Column 11 is the product of either Column 5 times Column 10 or Column 9 times Column 10.

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-6. COST OF FURNITURE USED IN INSTRUCTIONAL PROGRAM

(1) Furniture	Furniture Purchased for Instructional Program								(10) Percent of Time Used	(11) Total Annual Cost for Furniture*
	Previous Purchases				Purchased This Year					
	(2) Original Cost	(3) Life Span	(4) Amt. of Previous Depreciation	(5) Annual Depreciated Cost	(6) Original Cost	(7) Life Span	(8) Non-Depreciated Supplies	(9) Annual Depreciated Cost		
1.										
2.										
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14.										
15.										
16.										
17.										
18.										
19.										
20.										
TOTAL										

*Line entry for Column 11 is the product of either Column 5 times Column 10 or Column 9 times Column 10.

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-7. TOTAL COST OF EQUIPMENT AND FURNITURE USED BY INSTRUCTIONAL PROGRAMS

(1) Instructional Programs	Equipment			Furniture			(8) Total Annual Cost - Sum of Columns 4 & 7
	(2) Total Previous Depreciated Cost (V-5, Col. 5)	(3) Total New Depreciated Cost (V-5, Col. 9)	(4) Total Depreciated Cost for Equipment (V-5, Col. 11)	(5) Total Previous Depreciated Cost (V-6, Col. 5)	(6) Total New Depreciated Cost (V-6, Col. 9)	(7) Total Depreciated Cost for Furniture (V-6, Col. 11)	
1.							
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17.							
18.							
19.							
20.							
TOTAL							

Vocational Instructional Program Cost Data

C/E FORM V-8. BUILDING SPACE, USE, AND TIME/FLOOR DATA FOR INSTRUCTIONAL PROGRAM

(1) Instructional Programs	(2) Sq. Ft. Per Program	+	(3) Prorated Other Space*	=	(4) Total Sq. Ft. Per Program	X	(5) Number of Voc. Hrs. Used Per Year	=	(6) Time/Floor Unit For Instructional Program	÷	(7) Time/Floor Unit For All Vocational Programs**	=	(8) Percent Of Time/Floor
1.													
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.													
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13.													
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15.													
16.													
17.													
18.													
19.													
20.													
TOTAL													

*Prorated other space = halls, restrooms, office space not connected to program. Subtract Form V-8, Column 2 total from Form I-2, Column 2, Line 1.
**Time/floor unit for all vocational programs can be obtained from Form I-2, Column 4, Line 1.

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-9. BUILDING USE COST DATA

(1) Instructional Programs	(2) Instructional Program Sq. Ft. Space	÷	(3) Total Building Sq. Ft. Space Housing Inst. Program	=	(4) Percent Total Space	X	(5) Original Cost Of Building	=	(6) Cost for Voc. Space	÷	(7) Life Span	=	(8) Depreciated Annual Cost
1.													
2.													
3.													
4.													
5.													
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19.													
20.													

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-10. OTHER DIRECT COST
(for example: secretary, teacher aids, contracted services, etc.)

(1) Instructional Programs	(2) Costs
1.	
2.	
3.	
4.	
5.	
6.	
7.	
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9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
TOTAL	

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-11. SUPPORTING SERVICES COST PRORATED TO INSTRUCTIONAL PROGRAM: _____

(1) Line Item	(2) Costs	(3) Corporation Proration Basis*	(4) Prorated Costs Per Unit	(5) # of Instructional Program Units**	(6) Total Proration Cost/ Instructional Program
20000 Support Services					
21000 Student Services		ADM:		ADM:	
22000 Instruction Staff		FTE:		FTE:	
23000 General Administration		FTE:		FTE:	
24000 School Administration		ADM:		ADM:	
25000 Business Services					
25200 Fiscal Services		FTE:		FTE:	
25300 Facilities Acquis. & Const.		FTE:		FTE:	
25400 Oper. & Maint. of Plant		T/F:		T/F:	
25500 Student Transportation		ADM:		ADM:	
25600 Food Services		ADM:		ADM:	
25700 Internal Services		FTE:		FTE:	
26000 Central Services		FTE:		FTE:	
27000 Other Support Services		FTE:		FTE:	
TOTAL					

*Data for ADM, FTE and T/F can be obtained from Form I-1 and I-2.
**Data for Instructional ADM can be obtained from Form II-1; Instructional FTE from Form V-1; and Instructional T/F from Form V-8.

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-12. PRORATED SUPPORTING SERVICES COST PER INSTRUCTIONAL PROGRAM

(1) Instructional Programs	(2) Total Proration Cost Per Instructional Program*
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
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TOTAL	

*Data can be obtained from individual program sheets Form V-11.

OE 800 30 1984

Vocational Instructional Program Cost Data

☐ Budgeted
☐ Actual

C/E FORM V-13. SUMMUATION SHEET FOR INSTRUCTIONAL PROGRAM COST

(1) Instructional Programs	(2) Salary Cost (Form V-1 Col. 2)	(3) Fringe Benefit Cost (Form V-2 Col. 5)	(4) Travel Cost (Form V-3 Col. 4)	(5) Supplies & Materials Cost (Form V-4 Col. 5)	(6) Equipment & Furniture Cost (Form V-7 Col. 8)	(7) Building Use Cost (Form V-9 Col. 8)	(8) Other Direct Costs (Form V-10 Col. 2)	(9) Prorated Supporting Service Cost (Form V-12 Col. 2)	(10) Total Instructional Program Cost
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